INSTITUTE FOR DEFENSE ANALYSES

# Assessment of Accelerated Acquisition of Defense Programs

Richard H. Van Atta
R. Royce Kneece, Jr.
Michael J. Lippitz

September 2016



IDA Paper P-8161
Log: H 16-001036

INSTITUTE FOR DEFENSE ANALYSES
4850 Mark Center Drive
Alexandria, Virginia 22311-1882

*The Institute for Defense Analyses is a non-profit corporation that operates three federally funded research and development centers to provide objective analyses of national security issues, particularly those requiring scientific and technical expertise, and conduct related research on other national challenges.*

**About This Publication**
The work was conducted by the Institute for Defense Analyses (IDA) under contract HQ0034-14-D-0001, Project AB-6-3685, "Assessing Weapon System Acquistion Cycle Times," for the Assistant Secretary of Defense for Acquisition. The views, opinions, and findings should not be construed as representing the official position of either the Department of Defense or the sponsoring organization.

**Acknowledgments**
The authors are grateful to Dr. David Tate and Ms. Christina Patterson for their thoughtful reviews.

INSTITUTE FOR DEFENSE ANALYSES

IDA Paper P-8161

# Assessment of Accelerated Acquisition of Defense Programs

Richard H. Van Atta
R. Royce Kneece, Jr.
Michael J. Lippitz

This page is intentionally blank.

# Executive Summary

Since the collapse of the Soviet Union, the global security environment has become highly uncertain and complex with the United States having to address varied and changing threats, an environment that is likely to continue. Thus, even with the best possible prognostications, there likely will arise adversary capabilities for which we do not have a pre-developed response. In addition, technological advancements have accelerated, and some adversaries appear to be exploiting those advances more effectively than the U.S. Department of Defense (DOD). Those developments have led to concerns that the DOD's acquisition system is not sufficiently responsive to the rapidly changing world of both technology and operational challenges.[1]

Thus, the Institute for Defense Analyses (IDA) was asked to conduct research focused on the "cycle time" of DOD acquisition processes—i.e., how long it takes to acquire and field new force capabilities. Earlier phases of the research investigated how DOD sets schedules for Major Defense Acquisition Programs (MDAPs), and how the standard requirements and acquisition processes could be more responsive. We found that performance and cost generally took precedence over schedule in program tradeoffs. In few instances were schedules given explicit consideration. The current research phase, by contrast, focuses on past efforts to *accelerate* acquisitions in response to rapidly changing environments.

DOD has taken various approaches in the past to accelerate weapon system acquisitions. Starting in 2003, DOD initiated several rapid or accelerated acquisition approaches to meet urgent operational needs. Those, together with other historical efforts, suggest five main categories of accelerated acquisition defined by requirements urgency, requirements specificity, and technology availability:

1. Time-constrained acquisition
2. "Crash" program
3. Rapid acquisition
4. Early fielding experiments
5. Spiral/evolutionary acquisition

To identify such programs, we reviewed major defense acquisitions since 1975 (which number about 330) and found an initial set of 18 programs that qualified as accelerated acquisitions according to the above criteria (leading to an observation that accelerated

[1] Ashton Carter, "Running the Pentagon Right," *Foreign Affairs*, January/February 2014, 101-112.

acquisition has been relatively infrequent and mostly during times of conflict). From this set, we selected 11 programs, shown in the table below, for detailed assessment to derive insights and lessons applicable to the larger defense acquisition process.

**Accelerated Acquisitions Selected for Analysis**

| Program | Category |
| --- | --- |
| F-117A Stealth Attack Aircraft | Crash/rapid/time constrained/spiral |
| Mine-Resistant/Ambush-Protected Vehicle (MRAP) | Rapid/time constrained |
| Stryker wheeled infantry fighting vehicle | Rapid, spiral |
| MC-12W “Liberty” surveillance aircraft | Rapid |
| Predator unmanned aerial vehicle | Early fielding/spiral |
| Global Hawk unmanned aerial vehicle | Early fielding/spiral |
| Reaper unmanned aerial vehicle | Early fielding/spiral |
| Warfighter Network-Tactical (WIN-T) | Rapid, spiral |
| Littoral Combat Ship (LCS) | Time constrained/spiral |
| Future Combat System (FCS) | Time constrained |
| Joint Air-to-Surface Strike Missile (JASSM) | Time constrained/spiral |

## A. Key Findings

Most of the accelerated programs subjected to detailed review were driven by either (1) unanticipated, urgent wartime needs or (2) efforts to insert new technological capabilities into weapon systems via operational experimentation and assessment.

In the first case, proven technologies were employed to meet current needs, usually identified by a Combatant Command when performing military missions. MRAP, Stryker, MC-12W, and WIN-T Increment 1 are examples; their acquisitions exploited existing foreign or commercial capabilities and used components from existing DOD systems to configure solutions adapted quickly to U.S. operational needs. Some, such as WIN-T and Stryker, subsequently evolved into even more capable systems through infusion of more advanced technologies. MRAP and MC-12W ultimately were successful programs, but intervention by the Secretary of Defense was needed to overcome serious bureaucratic obstacles that substantially delayed their availability to operational forces. The Army Chief of Staff instigated and remained involved in the Stryker program.

The second case of accelerated acquisition entailed operational experimentation with immature, under-exploited technologies, developing and demonstrating innovative capabilities for which a formal military requirement did not yet exist. Predator, Global Hawk, and Reaper unmanned aerial vehicles (UAVs) are examples of this approach. Those

programs employed non-standard development and acquisition processes that pushed technological capabilities into the operational environment.

Those programs illustrate that when combined with such positive factors as realism about available technologies, a well-managed program can result in a successful rapid acquisition. By contrast, LCS and FCS were top-level initiatives that had adverse consequences. The difference is the willingness to mold requirements to available acquirable capabilities and the lack of significant technological hurdles.

A far more rare case is a "crash" technology development program to meet an urgent need. The F-117A stealth aircraft is an example that entailed developing and fielding a new military aircraft system in four years. It was executed in a non-standard manner as a highly classified program managed with the direct oversight and involvement of the Office of the Secretary of Defense (OSD), and in particular the Secretary of Defense himself.

Other accelerated acquisitions in the 1995-2005 period, including JASSM and LCS, were driven by aggressive acquisition reform agendas. These were time constrained but not due strictly to a threat imperative. The acquisition reform objectives led to systems with exceptionally compressed and concurrent schedules that proved to be highly optimistic and created major issues, including large increases in acquisition costs and substantial delays. The extreme case was the FCS, which Secretary of Defense Robert Gates cancelled after the Army spent more than $10 billion with little hope of achieving the capabilities projected. LCS and FCS also are examples of the imposition of top-down time (and in the case of LCS, cost) constraints that proved to be unexecutable.

In some important cases, substantial near-term and sometimes longer-term value for military operations resulted from taking a non-standard approach to shorten acquisition times. Mine-Resistant/Ambush-Protected Vehicles (MRAPs) are believed to have saved a substantial number of American lives, and even more seriously wounded,[2] in Iraq and Afghanistan by providing enhanced protection from attacks on troops with improvised explosive devices, which was the largest cause of casualties to allied forces early in the Iraq war. The F-117A provided a new alternative to the North Atlantic Treaty Organization (NATO) for countering Soviet threats to Western Europe, as well as providing the United States a decisive edge in the 1991 Gulf War. Advanced UAVs (Predator, Global Hawk, Reaper) filled serious gaps in surveillance and reconnaissance for allied operations in Bosnia and were later deployed with great effect in Iraq and Afghanistan, adding target designation and strike capabilities. They continue to provide important military capabilities.

[2] Numerical estimates have been the subject of debate—see Section 2.C.

All of these examples skipped or rushed certain planning steps, management reviews, or development and testing regimens, and thus introduced risks that standard acquisition processes are specifically designed to avoid. Examples of risks that actually materialized include: for the JASSM program, poor reliability and high cost and schedule growth; for MRAP, thousands of surplus systems after the major scale back in operations in Iraq and Afghanistan; and for Global Hawk, requirements growth, substantial cost increases, and delays when it transitioned into an MDAP.

None of those capabilities would have been fielded without special measures, including:

- Very high priority from departmental and/or service top management
- Use of Advanced Concept Technology Demonstrations (ACTDs)
- Use of innovative contractual approaches, such as "Other Transaction Authorities"[3]
- Special highly focused management approaches, review boards, or program offices
- Mechanisms for identifying and using existing capabilities—especially from commercial and foreign sources—to meet immediate needs
- Rapid acquisition mechanisms[4] to respond to urgent needs

## B. Conclusions

Acquisition programs should be accelerated when the value of having the operational capability sooner is compelling, weighed against the very real risks of skipping or rushing steps in the standard acquisition system. That tradeoff requires an assessment that balances current and projected requirements with existing and expected technologies available to meet them. When the tradeoff favors an accelerated acquisition, our research identified the following keys to success:

- Exploitation of innovative military capabilities outside areas of current interest of the military services generally requires intervention of top management in the OSD and/or the military services.
- Mechanisms to prototype novel systems capabilities and experiment with them in operational environments to gain user feedback have been successful in promoting innovation in defense capabilities. Examples include Predator/Reaper and Global

---

[3] A type of contractual agreement authorized by Title 10 United States Code, Section 2371, that greatly reduces delays in awarding and administering certain types of contracts.

[4] Bypassing or greatly shortening steps in usual acquisition practices and accelerating contract awards. Many such steps require high-level approval to waive provisions in statutes and regulations.

Hawk UAVs. (After the tasking of this research, DOD launched an initiative[5] to increase prototyping and experimentation. The outcome of that initiative is to be determined.)

- The acquisition process has demonstrated an ability to respond rapidly to urgent operational needs by exploiting existing systems and technologies. However, those efforts require strong leadership support to overcome bureaucratic obstacles and immediately available funding, much of which was provided in the past by contingency funds. However, with the winding down of U.S. engagements in Iraq and Afghanistan, support for the enabling mechanisms is on the decline. If allowed to wither entirely, it will be more difficult to reinstate such processes when needed in the future.
- Crash development of an advanced new capability for high-priority current or emerging problems requires top-level focused management and oversight. Those opportunities likely will be rare, but could be very important.
- An accelerated acquisition needs to be accompanied by attentive and responsible leaders, both military and civilian, who put priority on meeting urgent needs in the field, particularly for protection of troops. A common theme among the programs considered in this research is that such innovative capabilities were introduced and achieved by mechanisms that did not follow all the steps in standard requirements and acquisition processes. In fact, for some cases, few of the normal steps were followed.

## C. Recommendations

Timely innovation to meet future needs requires a coordinated program of technology development linked with prototyping and operational experimentation and employment. Processes to achieve those ends exist to some extent but need to be revitalized and funded with higher priority. The following principles should guide those efforts:

- – Select a few promising technologies for development and maturation, focused to support potential future concepts and managed by Assistant Secretary of Defense, Research and Engineering, in coordination with service equivalents.
- – Develop and integrate such concepts as operational prototypes and conduct experiments with them in operational environments with the operational users.

5 Memorandum, "The Defense Innovation Initiative," Secretary of Defense Chuck Hagel, November 15, 2014, and articulated earlier under Better Buying Power 3.0.

– Define processes and organizational structure for transitioning and incrementally improving such capabilities based on user feedback.

– Tailor iterative, evolutionary processes to acquire the systems, if scale-up is indicated by the projected operational environment and buttressed by positive user feedback.

The responsible organizations throughout DOD charged with assessing operational environments and identifying gaps that can be closed by current or evolving technologies should be strengthened. Programs with those objectives should be adequately funded and sustained to continually foster and support rapid development, acquisition, and fielding of state-of-the-art capabilities in the force.

# Table of Contents

# 1. Introduction

The "Better Buying Power (BBP)" initiatives of the Under Secretary of Defense, Acquisition, Technology and Logistics (USD (AT&L)) seek to significantly improve the Department of Defense's (DOD's) management of acquisition programs. BBP 2.0 and BBP 3.0 contain objectives of reducing cycle time while ensuring sound investments. BBP 3.0 notes that, "As concerns about technological superiority mount, the priority given to shortening cycle time in general will increase. This may manifest itself in more highly streamlined approaches that explicitly accept risk in exchange for acquisition speed." [6]

In previous work, the Institute for Defense Analyses (IDA) reviewed several Major Defense Acquisition Programs (MDAPs) to determine what processes and techniques were used to establish acquisition program schedules, including understanding and documenting what, if any, tradeoffs between requirements and schedule were considered in deciding on the technologies to be used in the programs.[7] The research presented in this paper builds on those findings and focuses on assessing accelerated acquisition.

## A. Objective and Approach

The purpose of this research is to conduct analyses that document the processes and methodologies used and identify issues or concerns regarding factors that impair the abilities of defense acquisition organizations to assess or conduct tradeoffs that would meet the intent expressed in BBP 3.0 *for accelerated acquisition*. From that assessment, the study team sought to identify best practices for reducing cycle times and developed recommendations for improved policies and procedures for accelerated acquisition that, when implemented, would result in a DOD acquisition system that is more responsive to user needs.

## B. Task

The BBP 3.0 implementation category would "reduce cycle time while ensuring sound investments" and asked for analysis of:

---

[6] Frank Kendall, *Better Buying Power 3.0*, White Paper, Office of the Under Secretary of Defense (Acquisition, Technology and Logistics), September 19, 2014, 8.

[7] Richard Van Atta, R. Royce Kneece, Jr., Christina Patterson, Anthony Hermes, Rachel Dubin, *Assessing Weapon System Acquisition Cycle Times: Setting Program Schedules*, Alexandria, VA: Institute for Defense Analyses, IDA Document D-5330, June 2015.

> … case studies of previous accelerated acquisition programs, especially those conducted in support of operations in Iraq and Afghanistan, to glean lessons learned that can be applied to future efforts. The analysis will study the trends and risks associated with program factors (e.g., complexity, software content, concurrency, prior technology maturation, and delegation), functions (e.g., testing, quality assurance) and review/oversight approaches (e.g., rapid acquisition, skunk works).[8]

BBP 3.0 also references the Accelerated Acquisition Program, or Model 4, in Department of Defense Instruction (DODI) 5000.02[9] regarding tailoring acquisition has the explicit goal of accepting risk and reducing "time to market."

IDA was asked to conduct an assessment of accelerated acquisition programs to support this provision.

Issues regarding rapid and accelerated acquisition are, of course, not new in DOD. In fact, experience over the past 13 years that attempts to respond to demands of forces involved in the Iraq and Afghanistan contingency operations is quite deep and has resulted in the institution of rapid and, to a lesser extent, accelerated acquisition processes. In fact, most of the programs selected for in-depth research for this task came from that wartime experience. These developments are summarized in Appendix A and provide useful background for the current research.

## C. Approach

Our first step was to select a set of acquisition programs for analysis that plausibly could be considered "accelerated." Unfortunately, there is no well-defined and agreed-upon criteria to identify programs as "accelerated acquisitions."[10] Therefore, the research team used its experience and drew upon that of others at IDA and in DOD to develop an initial list of candidate accelerated acquisition programs, as depicted in Table 1. We believe that the programs on this list qualify in some way as having attempted or realized an acceleration of the intended defense capability into military operations. Most of these programs were in

---

[8] Frank Kendall, "Implementation Directive for Better Buying Power 3.0 – Achieving Dominant Capabilities through Technical Excellence and Innovation," U.S. Department of Defense, Office of Under Secretary of Defense (Acquisition, Technology and Logistics), April 3, 2015, 20.

[9] Department of Defense Instruction (DODI) 5000.02, "Operation of the Defense Acquisition System," January 2015.

[10] Indeed, even the broader category of "tailored acquisition" proved difficult to identify in a recent RAND study. See Megan McKernan, Jeffrey Drezner, John Sollinger, *Tailoring the Acquisition Process in the U.S. Department of Defense*, Santa Monica, RAND Corporation, 2015. Both DOD's BBP 3.0 and the DODI 5000.02, cited above, discuss accelerated acquisition with the intent to recommend programs be accelerated when that would be beneficial. To identify whether past programs were accelerated or not requires that their management approach be reviewed relative to that of "standard" programs.

some way irregular—they deviated, often substantially, from what may be termed “standard” acquisition.

**Table 1. Identified Accelerated Acquisitions since 1975**

| System | Type of system | Scale | Description | Timeframe |
|---|---|---|---|---|
| F-117A | Stealthy strike aircraft | Non-MDAP | "Skunk works" | 1978-1985 |
| Predator | Unmanned Aerial Vehicles (UAV) | MDAP | Mid-altitude Advanced Technology Demonstrator (ACTD) | 1993-2011 |
| Global Hawk | UAV | MDAP | Large UAV-Originally ACTD | 1995-ACTD; 2001-MDAP |
| Command Post of the Future (CPOF) | Communications, Command & Control (C3) System | Non-MDAP | Integrates data feeds from other systems into a tactical operating picture | 1997 Defense Advanced Research Projects Agency (DARPA); 2003-4 experimental use |
| Phraselator | Electronic | Non-MDAP | Hand-held language translator | 2000 |
| Packbot | Robotic | Non-MDAP | Small robot for mine-clearing, improvised explosive devices | 2000 |
| Reaper | UAV | MDAP | Mid-size MAE Weaponized UAS | 2000-2015 |
| Stryker | Lt-wt. wheeled arm. veh. | MDAP | Non-Developmental Items with some integration | Early 2000s |
| Littoral Combat Ship (LCS) | Small combat ship | MDAP | Originally to be based on commercial ferries | Early 2000s |
| Mine-Resistant Ambush-Protected Veh. (MRAP) | Armored Pers. Carrier | MDAP | Armor protection for transporting troops | 2003-2010 |
| Warfighter Information Network-Tactical (WIN-T) Incrément 1 (Joint Network Node (JNN)) | C3 system – satellite terminals | MDAP | Adapted/integrated commercial equipment | Initial proc. in 2004. Designated MDAP in 2007 |
| ARH-70 Arapaho ("ARH") | Scout helicopter | MDAP | "Compressed" interim term program to replace OH-58s | 2005 Milestone-B |
| MC-12W "Liberty" Aircraft | ISR aircraft | Non-MDAP | Persistent surveillance, target acq. and designation | Begun April 2008, last delivery was Sep-09 |
| Future Combat System (FCS) | Ground combat “system of systems” | MDAP | Multiple manned/unmanned ground vehicles in an advanced network | Began Nov. 2000, cancelled 2009 |
| Joint Air-to-Surface Munition (JASSM) | Air-launched stealthy cruise missile | MDAP | Air-to-surface cruise missile for long range strike | Begun Sept. 1995; IOC 2004 |
| MV Cape Ray | Chem Weapons DeMil Ship | Single system | Integration of equipment to demil Syrian munitions | Early 2014 |
| Long-Range Air-to-Surface Missile | Air-to-surface missile | MDAP | Primarily anti-surface ship | Current |
| Common Infrared (IR) Countermeasures | IR Missile Countermeasure | MDAP | Counters IR missile threats to Helos | Current |

### 1. Standard versus Accelerated Acquisition

The DOD acquisition system pivots on requirements. The fundamental question is, what threat or modernization need has to be addressed? The next question: Does meeting that threat or need require a materiel solution, and if so, does the solution require new technical capabilities to be developed, acquired, and deployed? Then: When will the need have to be addressed? The standard acquisition system seeks to develop the needed technical capabilities in sufficient time to mitigate postulated future threats or replace aging or obsolescent systems.[11] This planning and decision-making process relies on intelligence to assess threats, and technology assessment and development processes to provide future technical capabilities. New weapons system acquisition programs are developed and funded based on such *anticipatory* processes.

Weapons capabilities generally are acquired through deliberate, highly structured processes to determine what the best solution would be, using a systems development process that assesses alternatives and decides what needs to be produced. The development and production of the system is then put through rigorous review, testing, and oversight processes, usually managed by a military service and overseen by OSD. This process includes the overall deliberation of priorities in these requirements relative to technical possibilities and constrained resources. Throughout the process, choices have to be made regarding what must be achieved relative to an evaluation of the operational demands and technical possibilities, given the resources available. The process is daunting—it necessitates that future threats be anticipated and future technological capabilities be developed, both of which are subject to a great deal of uncertainty. Also uncertain is the timeframe: When will the prospective threat manifest and when will the technologies be available to offset it? It is within this context that the defense acquisition system develops programs.

Given those complexities and uncertainties, the DOD faces concerns that the acquisition system overall is not sufficiently responsive to the rapidly changing world of defense technology and security challenge.[12] The deliberate, encompassing defense acquisition system that has evolved to support major defense acquisitions is seen by many as too cumbersome and unresponsive to address emerging defense needs. To meet such challenges, various approaches for accelerated acquisition have been employed, and DOD recently has

---

[11] The question, "How much will it cost?" is also a driving factor—indeed some have contended that cost should be treated more as a requirement in defense acquisition. See Jacque Gansler and William Lucyshyn, *Cost as a Military Requirement*, College Park, MD: University of Maryland Center for Public Policy and Private Enterprise, January 2013.

[12] Ashton Carter, "Running the Pentagon Right," *Foreign Affairs*, January/February 2014, 101-112.

put forward approaches to be considered in developing weapons acquisition programs faster.[13]

The uncertainties in both future threats and emerging technologies pose difficulties for setting acquisition program approaches and schedules, which in turn has resulted in both inefficiencies in meeting needs in a timely manner and unfulfilled needs (capability gaps). The first problem is the long time it takes to develop major defense systems. This can result in resources being expended on systems that subsequently prove to be insufficient to meet the need, are too costly, or take so long as to be no longer of value.[14] Moreover, the length of time it takes to bring these systems to fruition can mean that identified needs are unmet for years. In important cases, these systems have been fielded much later than the initial "required" initial operating capability (IOC) date; salient examples include the F-22 and the F-35 as well as many others. At other times, the system is so late and so costly that a decision is made to cancel the acquisition—even after tens of billions of dollars have been spent, as illustrated by the Future Combat System, which was initially an accelerated acquisition that, as will be discussed below, set schedules and cost objectives that proved to be highly unrealistic. In all of these cases, what could be produced by when was incorrectly determined, leaving massive downstream consequences in terms of both resources expended and unfilled mission capabilities. These instances, and many others, raise the question of whether an alternative approach to weapon systems acquisition that focuses on early fielding of capabilities could reduce or avoid such consequences.

Another issue is the uncertainty in predicting future needs, coupled with the need to make choices given resource constraints. This has led to unfulfilled capabilities that become apparent in current operations or in assessments of current and changing threats. If emerging requirements are seen as sufficiently serious—such as the improvised explosive device (IED) threat in recent conflicts—a quick response through accelerated acquisition processes is indicated. For needs identified as urgent, the requirements are clear and the time is now, so the acquisition focus is on finding solutions and identifying the resources needed to implement them. The issues are, how can DOD quickly allocate funding to projects that can rapidly produce solutions, and which projects should be done first given limitations in funding and other resources, such as personnel?

---

[13] See both BBP 3.0 and DODI 5000.02 cited above.

[14] Jacques Gansler, William Lucyshyn, and Adam Spiers, *Using Spiral Development to Reduce Acquisition Cycle Times*, College Park, MD: University of Maryland Center for Public Policy and Private Enterprise, 2008.

Over the last several decades, there have been a number of rapid or accelerated acquisition approaches to meet such needs—mostly during times of conflict.[15] With this in mind, we observed the main drivers of accelerated acquisition defined by:

1. Requirements urgency: At one extreme are urgent needs that arise or are projected to arise in the course of current or pending operations; at the other end are more distant future threats that require new capabilities to be developed.
2. Requirements specificity: In some cases, the threat or need is well understood and the required capability to address it can be specified in detail. In other, probably more prevalent, cases, the requirements are probabilistic judgments of possible futures.
3. Technology availability: At one extreme, the need can be met with systems that have already been built and are operating; at the other extreme would be a program to create a capability for which the technical feasibility is not established.

### 2. Time-Constrained Acquisition

One issue with defense acquisition is that often schedule is suborned by performance and cost. Trade-offs are mostly made by trying to achieve a set of "required" performance capabilities—speed, lethality, range, stealthiness, etc.—against funding constraints. The schedule is an outcome of the interaction of these two. As we noted in our previous work, rarely is schedule considered as a driver in the performance-cost-schedule assessment.[16] Although both BBP 3.0 and the latest DODI 5000.02 emphasize the need for trade-offs among these parameters (cost, schedule and performance), there is no explicit provision to consider the relative urgency of operational needs in making such tradeoffs. Moreover, there have been efforts—most notably in the Navy—to make schedule a Key Performance

---

[15] The problem of rapid response to deficiencies or gaps in military capabilities has a long history in U.S. defense weapons systems development and acquisition—going back to World War II with the Liberty Ships and the P-51 aircraft, and even the Manhattan Project. During the Korean War the United States faced the Soviet-built MiG-15 with the inadequate F-80s; the F-86 was quickly produced to supplant it. When faced with the threats of Soviet advances in nuclear capabilities, the U.S. defense quickly marshaled highly-focused, technically-driven responses for developing ICBMs (General Bernard Schriever) and nuclear submarines and submarine-launched ICBMS (Admirals Hyman Rickover and William Rayborn). During the Vietnam War, ARPA's Project Agile was a quick reaction program to get new technologies fielded to respond to the unanticipated needs of that conflict. Importantly, as with such more recent systems as the F-117A, these rapid responses to the threat required concerted, non-standard, and centrally managed development and acquisition approaches that the imperative of meeting the threat not only required, but facilitated relative to the existing priorities and acquisition practices. A lesson of history is that accelerated acquisition almost always requires non-standard processes and organizations.

[16] Richard Van Atta, R. Royce Kneece Jr., Christina Patterson, Anthony Hermes, Rachel Dubin, *Assessing Weapon System Acquisition Cycle Times: Setting Program Schedules*, Alexandria, VA: Institute for Defense Analyses, IDA Document D-5330, June 2015, 23.

Parameter (KPP). The notion here is that such an approach would (1) make schedule a more clear up-front consideration relative to what can be done and what can be afforded and (2) provide a means to keep schedules from being unduly pushed out during the acquisition by giving them greater scrutiny and management focus. Time-constrained acquisition can be thought of as a form of "accelerated acquisition" in the sense that it makes setting schedules and keeping on schedule a management priority. However, it in itself does not provide mechanisms for getting defense capabilities to forces more rapidly.

### 3. "Crash" Program

For cases in which the requirement is urgent and high priority, but the needed technologies are not fully developed, DOD may invest significant resources in programs to mature and field the needed technologies as rapidly as possible. Typically, these are secret programs separated from the ordinary acquisition system. Such crash programs generally will be undertaken only for extremely high-priority needs that offer change-state prospects since they, by definition, place extraordinary demands for resources and management oversight to assure the focus required to succeed and address the high risks. While they are usually costly, given the imperative, cost is not a driving concern. The Manhattan Project was such a program. The F-117A Stealth Fighter (one of our cases) is a more recent historical example. In both cases, it was unclear at the outset whether the desired capability was feasible, but the program aimed to achieve operational results in a very short time. Such combinations of technological opportunity and operational urgency occur rarely.

### 4. Rapid Acquisition

Soon after the beginning of the U.S. operations in Iraq and Afghanistan, DOD created various rapid acquisition programs and processes for raising, vetting, consolidating, and setting priorities among them (see Appendix A for a summary of policies and processes that were put in place). The highly urgent nature and specificity of the problems meant that, in general, only mature, "off-the-shelf" capabilities were applied. But for some cases in which a technical solution was not available (such as countering IEDs) or mature enough for procurement (such as Phraselator™), investments were also made in technology development and integration.

Such efforts include the Army's Warfighter Rapid Acquisition Program (WRAP) and the OSD Joint Rapid Acquisition Cell, which were established in 2004 in response to urgent needs stemming from U.S. engagements in Iraq and Afghanistan. Another ongoing rapid acquisition process is the Air Force's Big Safari, dating back to 1952, which was involved in several of the cases of accelerated acquisition reviewed here. These rapid acquisition programs typically employ or modify existing technologies and highly responsive and flexible acquisition approaches.

### 5. Early Fielding Experiments

Sometimes a capability is available or emerging, but none of the military services has an interest, let alone a formal requirement for it. As explained below, unmanned aerial vehicles (UAVs) in the 1980s and 90s are examples. In those cases small numbers of High Altitude Long Endurance UAV systems were built as operational prototypes and provided to combatant commanders in what were called Advanced Concept Technology Demonstrations (ACTDs) [17] to experiment with in the field in order to assess their potential military value and develop appropriate tactics, doctrine, etc. These early systems were focused on a small set of the most important needs, with new capabilities added as lessons were learned. While those successful experiments led to formal programs of record fairly quickly, there can be long delays if the capability in question is a "disruptive innovation" that threatens to overtake the mission of existing systems, as was the case with the Global Hawk. However, for both Global Hawk and Predator UAVs, dozens or more systems were fielded and used operationally in the demonstration process before transition to formal acquisition occurred.

### 6. Spiral/Evolutionary Acquisition

Spiral development initially was in response to large-scale failures in software development.[18] It uses a cyclical or iterative approach that allows users to provide feedback earlier and developers to identify potential problems at an early stage.[19] Through this approach, a new capability is developed in increments, whereby a piece of the system is developed, assessed, and if useful, acquired and deployed in operations with new capabilities integrated on a continuous basis. While initially the term "spiral" was used for larger-scale hardware-based defense systems, the term "evolutionary" acquisition has become more commonly used. Spiral development has been used largely for information technology systems, as exemplified by DOD's Command Post for the Future (CPOF). As explained in this document, some defense hardware applications, such as the Predator UAV can be considered to have been "spiral" developments. This approach is sensible when (1) the general direction of systems improvement is known but the full requirement cannot be specified in advance; (2) new operational requirements emerge when the system is placed in service; and (3) underlying component technologies are rapidly advancing such that components or parts soon become obsolete or can no longer be obtained.

---

[17] A DOD initiative begun in the mid-1990s to accelerate the fielding of technologies that were reasonably mature, yet not in use in deployed defense systems.

[18] Jacques S. Gansler, et al, *Using Spiral Development To Reduce Acquisition Cycle Times*, College Park, MD: University of Maryland, Center of Public Policy and Private Enterprise, May 14, 2008. Note: Agile development is a set of specific methods for iterative development of software. It uses an incremental build/test/build approach with close user involvement/feedback.

[19] Barry Boehm, "A Spiral Model of Software Development and Enhancement," *Computer*, May 1988, 61-72.

Evolutionary acquisition is the preferred DOD strategy for rapid acquisition of mature technology for the user. This approach has the objective to deliver initial capabilities in increments more quickly; allow for improvements and introduction of new technologies; balance needs and capabilities with resources; and take advantage of user feedback in refining requirements and capabilities.[20] DOD Open Systems/Modular Architecture initiatives encourage hardware programs to be designed with upgradability in mind, defining modular interfaces so that new technologies can be inserted without redesigning and requalifying the entire system.

These categories are approaches to provide for initial defense capabilities more expeditiously than the "standard" acquisition process. In this sense, they could all be considered "tailored" acquisition processes with the specific objective of getting some level of capabilities into the field quickly compared to the regular process. Moreover, these categories are not mutually exclusive. An acquisition may in fact reflect use of a combination of such approaches.

## D. Selecting Case Study Candidates

Using the categories developed above, the research team scanned the approximately 330 DOD weapons acquisitions over the past 40 years (back to 1975) for those that fit these categories of "accelerated acquisition." While our objective was to be encompassing of the types of categories, we recognize that we may not have captured all of these types of programs and that others might disagree on our inclusion or exclusion of one or more program. The initial 18[21] programs identified are depicted Table 1, showing an array of characteristics. From these, we selected the 11 programs seen in Table 2 for more detailed assessment as case studies. They were selected based on the availability of information about the program, including prior assessments on them as acquisition programs.

---

[20] Gansler and Lucyshyn, 2008, 8. See also Mark Lorell, et al., *Evolutionary Acquisition: Implementation Challenges for Defense Space Program,* Santa Monica, CA: RAND, 2006.

[21] Note that some of these are not MDAPs and some of the MDAPs shown began as other lesser programs. These 18 were selected in an effort to be reasonably inclusive and include some more informal acquisitions, such as Phraselator, as well as formal acquisitions.

**Table 2. Acquisitions Selected as Case Studies**

| System | Acquisition Approach |
|---|---|
| 1. F-117A | Crash/Time constrained/Spiral |
| 2. MRAP | Rapid/Time constrained |
| 3. Stryker | Rapid, Spiral |
| 4. MC-12W “Liberty” | Rapid |
| 5. Predator | Early Fielding/Spiral |
| 6. Global Hawk | Early Fielding/Spiral |
| 7. Reaper | Early Fielding/Spiral |
| 8. WIN-T (2007 restructure) | Rapid, Spiral |
| 9. Littoral Combat Ship | Time constrained/Spiral |
| 10. Future Combat System | Time constrained |
| 11. JASSM | Time constrained/Spiral |

# 2. Findings

An initial observation is that the number of accelerated acquisitions is quite limited and unevenly dispersed over the 40-year period from 1975-2015. Additionally, accelerated acquisitions are largely associated with periods of conflict. Perhaps this should be no surprise, since those periods created an imperative that motivated the use of non-standard practices, provided more available sources of funds, and focused upper management on setting priorities to address compelling user needs. In the late 1990s, after the fall of the Soviet Union, DOD implemented some "transformational" programs aimed at developing new capabilities using newly conceived "acquisition reform" processes that aimed to accelerate their fielding. These included JASSM, LCS, and FCS, all of which became troubled programs. Notably, no accelerated programs were identified in the mid-1980s to mid-1990s, which was the era of major defense build-up leading to the fall of the Soviet Union.[22]

## A. History of Approaches for Accelerating Defense Acquisition

Approaches for accelerating the acquisition of defense capabilities occurred in various contexts over the last 20 years of DOD acquisition policy promulgations. To better understand the evolution of the pertinent concepts in policy documents over time, the research team reviewed policy directives and instructions from 1996 to the present. The objective of the review was to identify (1) occurrences of the concepts of "evolutionary," "spiral," or "incremental" acquisition, and (2) guidance concerning technology demonstrators and experimentation that explore the application of new technologies and new applications of existing technologies in DOD force capabilities.

### 1. Spiral/Evolutionary Acquisition

The pertinent documents are Department of Defense Directive (DODD) 5000.01[23] and DODI 5000.02. The latter document is more detailed and thus of primary interest. The bottom line of this review is that the current DODI 5000.02 is notable as a sharp departure from previous iterations with regard to the topics researched. There is no mention of "evolutionary" or "spiral" acquisition processes in the current document (though there is mention of "evolutionary" in the current DODD 5000.01, which was published in 2003 and was updated modestly in 2007). Given that the instance in DODD 5000.01 does not carry

---

[22] There may have been some "black" programs other than the F-117A that fit the definition of accelerated acquisition, but classification makes these difficult to document.

[23] Department of Defense Directive (DODD) 5000.01, *The Defense Acquisition System*, November 2007.

through into the much more recent DODI 5000.02, those provisions are likely legacies of the past and for all practical purposes appear to be dead policy.

In fact, there has been a progression of reduced emphasis on the notion of spiral or evolutionary acquisition over time. The 2003 DODI 5000.2 defined evolutionary acquisition as comprising two distinct categories—“spiral acquisition,” in which the end-state requirements were not defined, and “incremental acquisition,” in which end state requirements were defined. (We did not investigate the degree to which this distinction has actually been reflected in MDAPs.) The next version of the DODI 5000.02, published in 2008, maintained an emphasis on evolutionary acquisition, but dropped the distinction between spiral and incremental. In fact, the term “spiral” does not appear at all in the document. Furthermore, an update to the DODD 5000.01, originally published in May 2003, struck-through the word “spiral,” and replaced it with the word “incremental” in the sentence:

> Evolutionary acquisition strategies are the preferred approach to satisfying operational needs. Spiral development is the preferred process for executing such strategies.

This is a clear indication of a conscious policy to eliminate the notion of spiral development as previously used. We do not know the reason; however, it could be speculated that developing all the required MDAP documentation when the end-state requirements were not defined was simply not feasible.

In 2009, the concept of subprograms was introduced for MDAPs. This allows successive increments of systems to be defined within the same MDAP; however, the end-state requirements for each increment must be defined. An example is the JASSM and JASSM-ER (extended range) missiles—the JASSM-ER is a longer-range missile and is defined as a subprogram under the JASSM MDAP. Prior to the implementation of subprograms, increments were sometimes defined as separate MDAPs. For example, when the WIN-T program was restructured after a Nunn-McCurdy breach in 2007, four separate MDAPs were set up.

### 2. Operational Experimentation and Acquisition

The degree to which ACTDs and experimentation are alluded to in DODD 5000.01 and DODI 5000.02 has also undergone significant swings in emphasis. There is a brief, but specific mention of ACTDs in the 1996 DODD 5000.1 in the context of “Non-Traditional Acquisition.” The 2003 DODI 5000.2, however, contains a more significant entry in the context of “Pre-ACAT[24] Technology Projects.” Mention in that context is continued in

[24] ACAT-Acquisition Category

subsequent DODI 5000.2/02s up to the current issuance, which contains *no references to technology capability demonstrators or experimentation.* Rapid prototyping is mentioned only for software-intensive developments.

## B. Case Study Development

The following factors and aspects were considered as the case studies were developed:

- Purpose
- System description
- Date of program initiation
- Date of first statement of requirement
- Initial operational capability (IOC) or, if no official IOC, the date of initial fielding or achievement of an operational capability.
- Scale of acquisition. Cost and quantities procured.
- Degree of urgency
- Degree of consensus
- Maturity of technologies
- Acquisition approach and outcomes

Depending on the system and the available information, some of these topics are covered in considerably more detail than others. The results of the assessment of the 11 identified accelerated acquisition programs are presented in the following sections.

## C. F-117A[25] "Nighthawk" Strike Aircraft[26]

**Purpose**: Penetrating stealth strike aircraft

**System description**: Stealthy, single-seat strike aircraft

**Date of program initiation**: 1975 (HAVE BLUE); 1978 (SENIOR TREND)

**Date of first statement of requirement**: 1974-75 – OSD statement of need; 1978 – SENIOR TREND requirements set

---

[25] Derived from Michael Lippitz and Richard Van Atta, "Stealth Combat Aircraft," in Richard Van Atta, et al., *Transformation and Transition: DARPA's Role in Fostering an Emerging Revolution in Military Affairs*, Volume 2 – Detailed Assessments, Alexandria, VA: Institute for Defense Analyses, IDA Paper P-3698, November 2003.

[26] Sometimes referred to as a "stealth fighter," but it was not a fighter but a strike or attack aircraft.

**IOC**. No formal IOC. First tactical group fielded in 1983

**Scale of acquisition**: MDAP-scale "black" (i.e., classified or Special Access) program (prior to MDAPs). Total build cost for 59 aircraft $6.5 billion (then-year); R&D costs $2.0 billion; procurement $4.3 billion.

**Degree of urgency**: This was an initiative driven by the Secretary of Defense personally to address an urgent need for a strike aircraft that could penetrate Warsaw Pact air defenses.

**Degree of consensus**: Initially program was known to a very limited number of OSD and Air Force leaders and involved contractors (Lockheed and Northrop); within the Air Force there was disagreement on the stealth concept.

**Maturity of technologies**: Underlying low-observable technology had been supported by earlier work by the Defense Advanced Research Projects Agency (DARPA), as well as Air Force (Lockheed) research and development (R&D). The key was to strictly limit use of most other technologies to those available. Some crucial sensor systems presented ongoing challenges.

### Acquisition approach and outcomes

Black program from initial demonstration to fielded aircraft. Contract was sole source with Lockheed "Skunk Works."

**Origins**. In 1974, Chuck Myers (Director of Air Warfare Programs in the Office of Defense Research and Engineering (DDR&E)) mentioned to Robert Moore (Deputy Director of DARPA's Tactical Technology Office—TTO) an idea he called the "Harvey concept," named after the invisible rabbit in a popular play and movie. The concept was to create a tactical combat aircraft with greatly reduced radar, infrared, acoustic, and visual signatures. A primary objective was to use only passive measures (coatings and shaping) rather than depending on support aircraft carrying jammers. Such a plane would allow for new types of deep air attacks, replacing the "air armada" tactics that had become the norm in Air Force and Navy aviation.

The "Harvey" idea was not entirely new, as low observable characteristics had been employed in classified reconnaissance aircraft (both manned and unmanned). However, there were no serious efforts to employ such capabilities on a weapons platform. To do this, significant advances in radar cross-section reduction were needed to overcome Soviet integrated anti-aircraft systems.[27] Myers wanted to fund aircraft companies to propose

[27] David Aronstein and Albert Piccirillo, *Have Blue and the F-117A: Evolution of the Stealth Fighter*, Reston, VA: AIAA, 1997, 10-11.

conceptual designs. Coincidentally, shortly after the Myers-Moore meeting, Director of DDR&E Malcolm Currie had issued a memo stating that he was not satisfied with the innovation coming out of DOD research. The memo also invited organizations to propose radical new ideas. Representing the TTO Office, Moore nominated the "Harvey" idea, renaming it "High Stealth Aircraft."

DARPA ultimately funded small preliminary studies at Grumman, McDonnell-Douglas, and Northrop. Three formal study contracts followed, awarded to McDonnell-Douglas, Northrop, and Hughes (for its radar expertise). While these studies were under way, Lockheed became aware of the project (Lockheed had not been invited to participate initially because it was not considered active in tactical aircraft) and contacted DARPA requesting permission to participate in the first phase concept development, without compensation. DARPA Director George Heilmeier granted the request.

**HAVE BLUE prototype.** By the summer of 1975, it was clear that only Lockheed and Northrop had credible, near-term concepts for making aircraft radically less visible to enemy antiaircraft radar. DARPA concluded that a full-scale flight demonstration would be needed to make the results convincing. Heilmeier insisted that the program should not go forward without Air Force backing. Air Force support was highly uncertain, since the Air Force saw limited value in a stealthy strike aircraft, given the severe performance compromises that would be required to achieve a very low radar cross-section. There were also competing Air Force R&D priorities, most notably the Air Combat Fighter program (which eventually became the F-16).

DDR&E Currie discussed the problem directly with General David Jones, the Air Force Chief of Staff, and General Alton Slay, the Air Force R&D Director. Although the Air Force remained skeptical as to a stealth strike fighter's value, Currie and Jones brokered a deal to obtain active Air Force support for the DARPA stealth program, provided that funding for the stealth development would not come out of existing Air Force programs, especially the F-16. The Phase 2 program—HAVE BLUE—began in 1976. Lockheed won the sole Phase 2 award, in part due to the record of its "Skunk Works" for on-schedule accomplishment of high-risk, high-classification projects, especially the SR-71 Blackbird.

HAVE BLUE was a quarter-scale proof-of-concept aircraft designed to evaluate Lockheed's concept for "very low-observable" capabilities while meeting a set of realistic operational requirements. The development program at Lockheed's Skunk Works was managed in an environment open to experimentation and flexible problem solving, with a high degree of communication among scientists, developers, managers, and users. OSD leadership kept the program focused and moving forward in the face of many fundamental uncertainties.

**Transition to Air Force—SENIOR TREND**. Successful flights of HAVE BLUE planes in 1977 made it clear that a stealthy aircraft could be built. Based on these results—

and guided by the high priority of countering Soviet numerical superiority with U.S. technology, as outlined in the Offset Strategy—Currie's replacement in the next administration, Under Secretary of Defense (Research and Engineering) (USD (R&E)) William Perry sought accelerated development of a real weapons system. The new Secretary of Defense Harold Brown agreed to make the development of stealth aircraft "technology limited" as opposed to "funding limited." The DARPA stealth program was then immediately transitioned to an Air Force acquisition program—SENIOR TREND— with an aggressive IOC of only four years, forgoing the normal development and prototyping stage. The objective was to build and deploy a wing of stealth tactical fighter-bombers (75 planes) as rapidly as possible. Furthermore, to obtain the largest possible technical lead, it was deemed necessary to hide the acquisition by making SENIOR TREND a highly classified "black" program.[28]

Perry established efficient and effective stealth program management procedures and employed a hands-on management approach to avoid problems, such as changes in mission and redirection of funding, which commonly derail programs in the traditional acquisition processes. Perry chaired special executive review panels, which met every two months. He retained decision authority—there was no voting. The Air Force program manager was instructed to highlight problems caused by bureaucratic delays, which Perry would address personally. (After a few such interventions, there were far fewer bureaucratic obstructions.)

Perry created a special umbrella program office that included stealth programs for ships, satellites, helicopters, tanks, reconnaissance aircraft, advanced cruise missiles, UAVs, and strategic bombers, as well as stealth countermeasures. Congressional support was secured and, once gained, proved indispensable. Because the program was highly classified, special access subcommittees of the House and Senate Armed Services Committees were established.

**Fielding**. The first F-117A was delivered in 1981, and 59 were deployed by 1990. In 1991, the F-117A was an outstanding success in Operation Desert Storm. The Air Force supported Lockheed's development of the aircraft, made provisions for an operational wing to be deployed, undertook an extensive testing program, and developed new operational practices to take advantage of the F-117A's special capabilities despite a variety of problems discovered during operational testing. Those risks, arising from concurrent development due to the accelerated schedule, were understood and accepted and hence did not disrupt the program. "Despite unforeseen and serious challenges, a small team was able to develop a

---

[28] Interview with William Perry, June 6, 2001. Also see William Perry, *My Journey at the Nuclear Brink,* Stanford, CA: Stanford University Press, 2015, 33-44.

radically new and important weapon system in record time, safely, and without compromising the initial objective."[29]

**Impact**. The stealthy F-117A helped the U.S. achieve early air superiority in Operation Desert Storm by striking critical, heavily defended targets with no aircraft losses.[30] It did so in the face of the same type of Soviet anti-aircraft systems that had been effective in Vietnam and the Yom Kippur War. In championing stealth, DARPA harnessed industry and the military service lab ideas to pursue a radical new warfighting capability. Stealth combat systems had not been pursued because the services lacked a strong interest in such a nontraditional concept. With high-level support from civilian leadership across administrations, DARPA overcame that resistance, defined priorities, and obtained funding for the considerable engineering work to develop a proof-of-concept aircraft demonstration system. This demonstration enabled top civilian and service leadership to proceed with confidence. OSD and service leadership, once persuaded, rose to the challenge, and provided funding and support to implement a full-scale weapons program—the F-117A.

The F-117A is an example in which specific enabling technologies for achieving stealth were relatively immature, but had some prior precedent. Moreover, the rest of the system development was kept highly controlled using off-the-shelf components to achieve the timely development of the system. In addition, the program was managed as a special, highly classified program with direct oversight from the then USD (R&E)—now equivalent to the USD (AT&L). The tradeoff between getting this capability produced relative to cost was explicit—this was a technology-driven program to address a critical threat where cost was, at most, a secondary consideration. This aircraft was developed and fielded under the highest levels of secrecy, leading to a "secret weapon" capability for several years and giving the U.S. more than a decade advantage over any adversary—exactly what DARPA and top DOD leadership had envisioned.

### Lessons Learned

The F-117A was a crash program aimed to develop and deploy a breakthrough capability in as short a time as possible. To achieve that objective required a highly focused technology development, prototyping, and acquisition approach. The approach was driven by a national-level strategic imperative, which was initiated by OSD and developed by DARPA. The subsequent implementation was through a highly classified Air Force Program with direct and close oversight of the USD (R&E). Throughout this process, the focus was

---

[29] LTC R. Mosely, "Senior Trend Test Program from Concept to Initial Operational Capability: Planned vs. Actual," briefing dated December 20, 1983, with cover memo from Colonel Michael E. Sexton to Colonel Paul G. Kaminski dated December 21, 1983, as quoted in Aronstein and Piccirillo, 111.

[30] An F-117A was lost to a surface-to-air missile over Serbia in 1999, the only F-117A lost in combat.

delivering an operationally capable stealth strike aircraft with an IOC within four years. The imperative of offsetting the Soviet air defense capabilities drove decisions on the structure of the program, the selection of the performer, and the oversight mechanisms. The program had ambitious but clear objectives that helped focus the contractor and the government on working together pragmatically to achieve the outcome.

The F-117A was a rare program in which technology push and demand pull were carefully controlled to meet a strategic need within an extremely short time frame. Although an adventuresome undertaking, the program was organized and managed with that intent. "The F-117A development is not a pattern for every program, but rather a useful example of how a unique technological opportunity can be quickly and effectively exploited to provide a valuable military capability at relatively moderate cost."[31] The strategy was to specifically limit the technology development to that needed for implementing the stealth capabilities and assiduously minimize any other technology development—using mostly off-the-shelf technologies.

## D. MRAP — Mine-Resistant Ambush-Protected (MRAP) Vehicle

**Purpose**: Armored troop carrier to protect troops, both combat and support, in irregular warfare operations

**System description**: A wheeled armored vehicle with a hull configuration to limit damage by land mines and IEDs. Several different configurations were procured from various suppliers. The Selected Acquisition Report (SAR) divides them into five categories depending on mission/purpose. They vary in size from 5 passengers to 11, in weight from 7 to 25 tons, in level of protection, and in degree of mobility.

**Date of program initiation**: MRAP was designated as an MDAP in September 2007 with a joint program office led by the Marine Corps. Marine Corps had previously procured small quantities of Cougar MRAPs from Force Protection Industries in 2004 for explosive ordnance disposal and engineer units.[32]

**Date of first statement of requirement**: Demands from the operational commanders in Iraq for better troop protection against IEDs began as early as June 2003. However, the first official statement of urgent operational need (UON) was by Marine Corps in February 2005.

---

[31] Aronstein and Piccirillo, 194.

[32] Thomas H. Miller, "Does MRAP Provide a Model for Acquisition Reform?" *Defense AT&L*, Vol. 39, No. 4, July–August 2010.

The Army's date of first statement of need is not known; however, in October 2006, Army requested the Marine Corps program office to procure 2,500 vehicles.[33]

Timeline for requirements statements:

- Draft UON from local commander "circulating in the Pentagon" Nov. 2003 (Lamb,[34] p.11)
- Local Marine Corps and Military Police commanders request armored security vehicles, June 2004 (Lamb, p. 12)
- First Marine Expeditionary Force Urgent Needs Statement for MRAPs submitted in February 2005 (not acted on by Marine Corps) (Howitz,[35] p. 4)
- MRAP program office created in Marine Corps Systems Command November 1, 2006 (Young, p. 3)
- Marine Corps program office releases Request for Proposal (RFP) in November 2006 (Miller, p. 18)
- Marine Corps awards contract for 1,000 MRAPs to Force Protection Industries, April, 2007 (Howitz, p. 5)
- The Secretary of Defense creates MRAP Task Force, May 2007 (Young, p. 2)
- The Joint Requirements Oversight Council (JROC) approves 7,774 MRAPs, May 2007 (Young, p. 4)
- JROC approves 15,374 MRAPs, September 2007 (Lamb, p. 12)

**IOC**: First Unit Equipped: Marine Corps—April 2007; Army—November 2007 (IOC October 2007) (December 2010 SAR)

**Scale of acquisition**: The program began as a Marine Corps Acquisition Category II; in February 2007, the Marine Corps acquisition executive authorized proceeding directly to Milestone C (Low-rate initial production). By September 2007, the requirement had grown to more than 7,000 vehicles, which qualified the program as an MDAP. The last SAR for the

---

[33] Miller, 2010, states: "Development of the acquisition strategy for rapidly acquiring and fielding the vehicles became more challenging for the Marine Corps MRAP program management office when the Army decided to add their requirements for up to 21,000 MRAP vehicles, with an initial quantity of 2,500 vehicles, just prior to release of the request for proposal in October 2006." 17.

[34] C. J. Lamb, et al., *MRAPs, Irregular Warfare and Pentagon Reform*, Institute for National Security Studies, National Defense University, Washington, D.C., June 2009.

[35] Michael C. Howitz, *The Mine Resistant Ambush Protected Vehicle: A Case Study,* Carlisle Barracks, Pa.: U.S. Army War College, March 2008.

program (Dec. 2010) reported total funding of $40.9 billion for 26,552 vehicles, 96% of which had been delivered.

**Degree of urgency**: High. Early in the conflicts in Iraq and Afghanistan, thousands of U.S. service members were killed or injured by IEDs. Better protection was a critical need because the vehicles used in these regions at that time were not designed to sustain blasts from below and, thus, provided little protection. Interest in providing soldiers with armored vehicles specifically designed to protect against this threat spread from the theater back to the Pentagon, eventually reaching the highest levels of leadership in the Pentagon and Congress. While the MRAP program was successful as a rapid acquisition program in that it fulfilled specific urgent operational needs of the Military Services[36] and Special Operations Command on an unusually short timeline once the requirement was acknowledged, the program was hobbled initially by non-responsive requirements processes in both services and Joint Staff.

**Degree of consensus**: Originally, there was a lack of consensus, resulting in a three-year delay in approval of the requirements. Various sources have speculated on the causes. One that seems likely is the view prevailing at the time that the Iraq war would end quickly and U.S. forces would not become bogged down in counterinsurgency operations in either Iraq or Afghanistan. Even after the initial approval, the Army and Marine Corps classified them as “unfunded requirement” in Congressional testimony in March 2007.[37] Finally, after intervention by the Secretary of Defense in May 2007, the consensus formed to expedite the programing in accordance with the secretarial priority.

**Maturity of technologies**: Similar vehicles had been in service in foreign forces (e.g., South Africa, Israel, United Kingdom) since the 1970s. In fact, the U.S. Army had bought MRAP-like vehicles known as Armored Support Vehicles in response to a 2003 urgent need by the Military Police in Iraq.

**Acquisition approach and outcomes**: In May 2007, the Secretary of Defense designated the MRAP program as DOD’s highest priority acquisition and appointed a department-wide task force chaired by the USD (AT&L), to integrate planning, analysis, and actions to accelerate MRAP acquisition. By assigning a “DX” priority for contracting, the secretary assured the availability of manufacturing materials, such as steel and tires.

The program employed a tailored acquisition strategy using non-developmental items. The program established minimal operational requirements, decided to rely on only proven technologies, and relied heavily on available products—largely, commercial or modified

---

[36] Primarily Army and Marine Corps, but Air Force and Navy also procured some vehicles.

[37] Lamb, et al., 14.

commercial products for the vehicle itself. The program also undertook a concurrent approach to producing, testing, and fielding the most survivable vehicles as quickly as possible. To expand limited existing production capacity, the department expanded competition by awarding IDIQ[38] contracts, originally to nine commercial sources; however, ultimately the vast majority of vehicles were produced by five vendors. Each vendor produced a unique vehicle, which greatly complicated the integration task. Funding was primarily with supplemental appropriations.

To evaluate design, performance, producibility, and sustainability, the Marine Corps committed initially to buy at least four vehicles from each vendor. The Marines and Army didn't know in advance which vehicles would prove to be the most useful, so they bought "a dozen of each", tried them in realistic (or real) operations, and winnowed out the useless ones from subsequent buys. Subsequent delivery orders were based on a phased testing approach with progressively more advanced vehicle test results and other assessments. To expedite the fielding of the vehicles, the government retained the responsibility for final integration of mission equipment packages, including installing radios and other equipment in the vehicles after they were purchased. Two Navy facilities in South Carolina performed most of the integration work, which was complicated by both the different vehicle designs and differing equipment requirements for each of the four services. A third integration facility was eventually established in Kuwait. When installation of the Government Furnished Equipment was completed, the vehicles were sent directly to the theater.

The necessary waivers were signed to ensure the timely availability of materials, such as steel and tires—for example, the use of steel from foreign sources is prohibited by law unless a waiver justifying an urgent need is executed by the acquisition authority. Some of the contractors involved in the acquisition responded to the urgency communicated by the department by investing their own capital early to purchase critical material and components in advance of orders.[39]

As of July 2008, nearly all of the developmental and operational testing had been completed; the Marine Corps, the buying command for the MRAP, had placed orders for 14,173 MRAPs; and, as of May 2008, a little more than a year after the first contracts were awarded, 9,121 vehicles had been delivered. MRAPs have reportedly provided safe, sustainable, and survivable transport for troops in the theater.[40] MRAPs have limitations, particularly in the area of off-road mobility and transportability. Nonetheless, MRAPs are

---

[38] Indefinite Delivery/Indefinite Quantity

[39] Michael J. Sullivan, *Rapid Acquisition of MRAP Vehicles,* US General Accounting Office, GAO-10-155T, Washington, DC: Government Printing Office, October 8, 2009, 6.

[40] GAO, 6.

considered outstanding vehicles for specific missions. Based on a survey of more than 300 soldiers interviewed in the field, warfighters were satisfied with MRAPs overall. MRAP vehicles were seen as well suited for combat logistics patrols, route clearance missions, raids, quick reaction forces, and other missions requiring large, dismounted force.[41] MRAP vehicles were seen as not well suited for mounted patrols in constrained urban areas or extensive use in off-road operations (they easily roll over and are difficult to get out of). Another criticism is that the large, ugly vehicles are intimidating and do not facilitate working effectively with the populace, and thus may be inconsistent with the generally accepted irregular warfare strategy of protecting and gaining the cooperation of local populations.[42]

DOD contacted the vendors that had been selected to produce MRAPs to find out what could be done to accelerate production. Based on the responses, in July 2007, DOD requested reprogramming authority to procure an additional 1,500 vehicles in 2007, with another 1,100 to be delivered in 2008 with the additional funds.[43] For FY2008, Congress created an "MRAP Vehicle Fund" with "purple" money that allowed maximum flexibility in use of the funds.

U.S. manufacturers of heavy specialty trucks were capable of producing vehicles based on existing designs. Ultimately, MRAP vendors successfully increased their production rates to meet the delivery requirements. Production began in February 2007 with one vendor producing 10 vehicles. By March 2008—a little more than a year after the contracts were awarded—6,935 vehicles were produced.

To get vehicles delivered as quickly as possible, the Marine Corps took a novel, two-pronged approach to the contracting process—a competition and a sole-source provider. One producer (Force Protection Industries, which had previously provided small quantities of vehicles to the Marine Corps) was given a sole source contract for as many vehicles as it could produce before the competitive procurement could be completed. The competition was for firm-fixed price IDIQ contracts to multiple vendors (basically, anyone who could produce a vehicle passing minimum test criteria). The competition RFP was released in November 2006. Ten proposals were received in December 2006. After an "extremely compressed"[44] source selection process, nine contracts were awarded in January 2007, for delivery of four vehicles each for acceptance testing. Concurrently, based on technical evaluation of the

[41] GAO, 7.

[42] Lamb, et al., 28.

[43] Young, 10.

[44] Miller, 18.

proposals, low-rate initial production (LRIP) contracts were awarded to five vendors in February 2007. Eventually, there were five volume producers. (See Figure 1.)

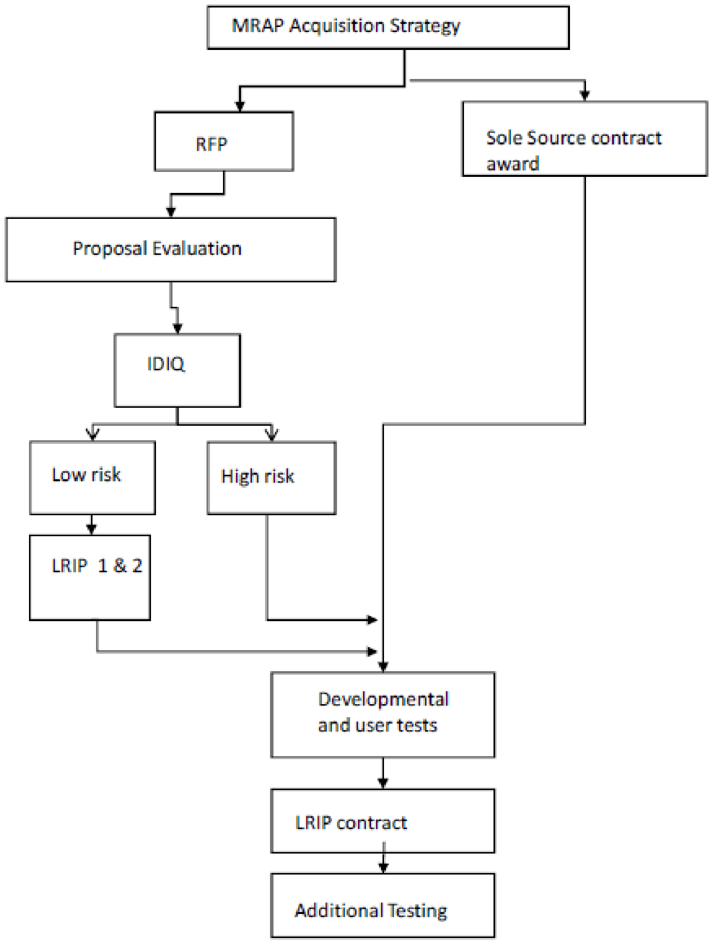


**Figure 1. MRAP Initial Contracting Process**[45]

Twenty-one months elapsed from the time the need was first identified in February 2005 until the sole source IDIQ contract was awarded and subsequent orders were placed for the first 144 vehicles in November 2006. Testing of delivered vehicles began one month later, in March 2007. Initial operational capability was accomplished in October 2007, about 33 months after the need was first identified.

---

[45] Seth T. Blakeman, Anthony R. Gibbs, and Jeyanthan Jeyasingam, *Study of the Mine Resistant Ambush Protected (MRAP) Vehicle Program as a Model for Rapid Defense Acquisitions*, Monterey, Calif.: Naval Postgraduate School, 2008, 31.

**Subsequent developments**: Supporting the fielded MRAPs proved predictably challenging. Initially, contractor logistics support was used, complicated by the multiple vendors involved.[46] As the number of deployed vehicles grew, contractor support became less feasible and organic support capabilities were put in place. An integration and repair facility was eventually established in Kuwait. When vehicles were redeployed from Iraq to Afghanistan, they had to be modified for the more austere conditions (e.g., for improved off-road performance). There was a reluctance to divert vehicle deliveries for both field and maintenance training.

Disposal of equipment is now an issue. After procurement of such a large number of vehicles so quickly, the Army and Marine Corps now must determine how many to keep in inventory and what the operational and support doctrines should be. Some MRAPs are in prepositioned stocks in Kuwait and a few have been given to Iraqi forces. According to press reports, many are being scrapped in Afghanistan. While MRAPs in decent working condition are being offered for sale, there are at least 13,000 excess MRAPs worldwide.[47]

**Lessons learned**

The MRAP program illustrates several important ideas about rapid or accelerated acquisition. The initial lack of consensus within the requirements communities of the services and Joint Staff delayed program initiation for about three years. Intervention by both Congress and the secretary was required to free the resulting logjam. Once a clear top-level priority was established, the acquisition system responded with remarkable speed and resourcefulness. It is difficult to say how such an outcome might be prevented in the future, since the situation that led to that outcome was unique. DOD civilian leadership is very reluctant to become involved in the "requirements processes," which are considered by many to be the prerogative of the uniformed military. This case is a powerful illustration of the fallacy of that point of view. Nonetheless, it must be borne in mind that what seems obvious in hindsight perhaps was not so obvious at the time.

Waste is virtually certain when maximum acceleration is applied to a complex process, and MRAP was no exception. Billions of dollars were spent on vehicles that now have limited value. The logistics system was heavily stressed to support the diverse, rapidly deployed vehicle fleets. The total cost of the program, including non-acquisition costs, will likely never be accurately determined, but it is estimated to be in excess of $50 billion.

---

[46] Michael E. Bulkley and Gregory C. Davis, *The Study of the Rapid Acquisition Mine Resistant Ambush Protected (MRAP) Vehicle Program and its Impact on the Warfighter*, Naval Postgraduate School, Monterey, California, June 2013, 30.

[47] David Zucchino, "From MRAPs to Scrap: U.S. Military Chops Up $1-million Vehicles," *Los Angeles Times,* December 27, 2013.

Such costs are offset by the casualties prevented by MRAP. While numerical estimates of the casualties prevented have been the subject of debate, it seems certain that the number was substantial.[48]

MRAP is a tale of a highly responsive procurement and deployment of a crucial operational capability only *after* a long delay in the need being recognized and acted upon.[49] Moreover, it is not unique—body armor, up-armored Humvees, and IED jammers were called out by Congressman Gene Taylor as prior examples of lack of responsiveness to the protection needs of soldiers deployed to Iraq and Afghanistan.[50] Perhaps it is too obvious to say that an accelerated acquisition needs to be accompanied by responsive, attentive, and responsible military officers and OSD and service executives who put priority on meeting urgent needs in the field, particularly for protection of troops.

## E. Stryker

**Purpose**: Combat vehicles for medium-weight armored units (Stryker Brigades)

**System description**: These vehicles are the backbone of the Army's Stryker Brigade Combat Teams (SBCT)—medium-weight units that combine significant combat power and troop protection with enhanced strategic mobility compared to traditional heavy armored units. There are 10 configurations in the Stryker family. These are wheeled vehicles based originally on the Marine Corps Light Armored Vehicle (LAV), which in turn was based on a Swiss-designed armored vehicle (The MOWAG Piranha).

**Date of program initiation**: November 2000 (Milestone II)

**Date of first statement of requirement**: Operational Requirements Document, April 2000

**IOC**: Army staff stated to the IDA team that the IOC was December 2002 and First Unit Equipped September 2002. (First SBCT deployed to Iraq August 2004). The December

---

[48] A report issued by the MRAP Joint Program Office cites as many as 40,000 lives saved. However, that figure has been the subject of debate in a series of articles in *Foreign Affairs*. See Chris Rohfs and Ryan Sullivan, "The MRAP Boondoggle, "*Foreign Affairs, July 2012;* Christopher J. Lamb and Sally Scudder, "Why MRAP is worth the money: Dispelling the Flawed Logic of One Battlefield Study," *Foreign Affairs*, August 2012*;* and, Ashton B. Carter and J. Michael Gilmore, "Running the Numbers on MRAPs: Reliable Data Proves the Vehicles are Worth the Money," *Foreign Affairs,* October 2012. The last article cited does not provide an estimate of casualties avoided but does present credible data and analysis to support a conclusion that the numbers are substantial.

[49] See Peter Eisler, Blake Morrison, and Tom Vanden Brook, "Pentagon Balked at Pleas from Officers in Field for Safer Vehicles,*" USA Today*, March 27, 2011, 1A, for details on the MRAP requirements issue.

[50] Lamb, et al., 14-15.

2010 SAR, however, reflects an IOC of November 2003 and first unit equipped of March 2003. The reasons for this discrepancy are not known.

**Scale of acquisition**: MDAP. As of the last SAR (December 2010), more than 4,000 vehicles have been produced (4,478 total planned), at a total program cost of $16.28 billion (Average unit procurement cost - $2.95 million). Army staff personnel told IDA that the total was now up to about $22 billion through FY 2013.

**Degree of urgency**: The Army's extremely slow deployment of a heavy brigade from Germany to Kosovo in the summer of 1999 convinced the Chief of Staff (General Eric Shinseki) that the Army needed units that could deploy faster and still have good combat power and protection. Thus, in October 1999, the idea of a medium-weight armored unit was born. A key aspect of this focus was the ability to deploy quickly—requiring a smaller and lighter vehicle, transportable by C-130 aircraft, and fully deployable in 96 hours "anywhere in the world." Another aspect was the ability to operate in urban terrain, in which heavy armored vehicles had proven operational deficiencies. Stryker was initially related to FCS as an interim solution, but as FCS was first delayed and then eventually cancelled, it became the de facto solution for medium-weight combat vehicles.

While the Army identified the program as an urgent need, the degree of urgency of that requirement can be questioned—arguably, the need for these capabilities existed previously. Many other countries have had such units for many years. Historically, the Army's belief was that only heavy armored units provided sufficient firepower, mobility, and protection—consistent with the requirements to fight the Warsaw Pact in Europe. After the dissolution of the Warsaw Pact, the Army started exploring conceptual organizations for the future—known as Army XXI and then as Army After Next. These concepts were governed by the perceived need for lighter forces that would exploit digitization and networking to increase effectiveness and reduce vulnerabilities. The Kosovo deployment occurred almost coincident with General Shinseki becoming Chief of Staff. He was appalled by the Kosovo fiasco, and immediately directed an acceleration of efforts to develop a lighter but still capable force, and designated selected units for experimental transformation. In December 1999, the Army began evaluation of a reported 35 candidate vehicles. In November 2000, the Army announced the selection of the LAV III as the main vehicle to equip these new formations.

**Maturity of technologies**: Vehicle technology was mature, at least for the basic variants. A number of similar vehicles were in production in the world. It was a matter of adapting a vehicle already in production for the Marine Corps and other countries to meet the Army's requirements. For all but two of the variants, the required modifications were small and straightforward.  Those variants were fielded quickly and successfully. For the Mobile Gun System (MGS) and Nuclear, Biological and Chemical (NBC) vehicle, the required modifications were major and difficult, with low technology maturity, and both of those variants took far longer (and were far more expensive) than planned.

**Degree of consensus**: Army staff personnel stated that General Shinseki personally intervened in numerous ways to keep the program on track. Extraordinary efforts were made to gain and maintain Congressional support.[51] These efforts were key to the program's success.

**Acquisition approach and outcomes**: Since, as indicated above, there were candidate medium-weight armored vehicles manufactured by several countries, the Army was able to launch an accelerated acquisition program easily. The Army maintains that a lot of concurrency was used—development, production, testing, deployment, and sustainment. This is an example of both tailored and evolutionary acquisition—the process was tailored to reflect the maturity of the production item available and evolved over time to meet new emerging requirements. Army staff personnel stated that the Office of Director, Operational Test and Evaluation, was brought in early in the test design process and did not raise roadblocks. One issue that arose with the Remote Weapon Station was resolved by stabilizing it. The prime contractor, General Dynamics, had a quick response team onsite to deal with any emerging problems. Reliability goals have been met from the start.[52]

LRIP began immediately after Milestone II for the basic configuration (Infantry Combat Vehicle). However, the other variants have been phased in over time. For example, Milestone III for the Nuclear, Biological and Chemical (NBC) vehicle was December 2011. Because of the large number of variants, each having its own LRIP, about 60% of Stryker vehicle production occurred as LRIP. The Mobile Gun System vehicle was only produced in LRIP before production was ended, at least temporarily, in 2012, primarily because of affordability concerns (but there were technical issues as well). The Army stated that the inventory was adequate to provide 9-12 systems per brigade and that was sufficient.

Overall, the Stryker program should be counted as a success. The Army's Stryker brigades have performed very well in Iraq and Afghanistan.[53]

### Lessons Learned

Within a service, top-level support from the Chief of Staff, when combined with such positive factors as realism about what is available and readily adaptable off the shelf, a well-managed program can result in a successful rapid acquisition. This program is in contrast to LCS and FCS, where top-level push had adverse consequences. The difference is the

[51] For example, a demonstration of C-130 transportability was held for the Speaker of the House.

[52] Discussions with Army staff specialists.

[53] See, for example, Mark, J. Readeon, and Jeffrey A. Charlston, *From Transformation to Combat: The First Stryker Brigade at War,* U.S. Army Center for Military History, Washington, D.C., November 2006.

willingness to mold requirements to available acquirable capabilities and the lack of significant technological hurdles.

## F. MC-12W “Liberty" Aircraft

**Purpose**: Provides tactical ISR, especially related to IED and other tactical intelligence, to ground forces.

**System description**: Commercial Hawker Beechcraft King Air 350 (seven used aircraft) and King Air 350ER (30 new production aircraft) equipped with a suite of ISR sensors, including the MX-15 electro-optical/infrared sensor turret; a laser designator; full-motion video capability; and signals intelligence (SIGINT) payloads. A fully operational system consists of a modified aircraft with sensors, a ground exploitation cell, line-of-sight and satellite communications data-links, and a robust voice communications suite.

**Date of program initiation**: April 2008. The Secretary of Defense established a task force to identify and recommend solutions for increased ISR for operations in Iraq and Afghanistan.

**Date of first statement of requirement**: Robert Gates, who was confirmed as Secretary of Defense in December 2006, notes his frustration in obtaining adequate ISR support for ongoing operations in his 2014 book *Duty*. In fact, a U. S. Special Operations Command (SOCOM) Joint Urgent Operational Need (JUON) for additional ISR support for ongoing operations was submitted to U.S. Central Command in November 2006, validated by Joint Staff in January 2007, and endorsed as an "Immediate Warfighter Need" by the Joint Rapid Acquisition Cell (JRAC) in February 2007. Despite those approvals, it took more than a year for the acquisition of additional ISR assets to be initiated. Availability of funds was a significant limitation because JRAC and lower-level Joint Staff action officers were unable to raise the issue with higher-level management. Reflecting his frustration, Secretary Gates states that in September 2007, he held a meeting to discuss the ISR problem. By then, the problem was receiving high-level attention. However, due primarily to the funding issue, little progress was made.

In early 2008, SOCOM conducted an industry survey for capabilities that could satisfy the JUON, and received a number of responses, for both manned and unmanned systems. Discussions were conducted regarding the most attractive proposals. Similar discussions with potential industry suppliers of ISR capabilities were held by the JRAC staff.

Finally, in April 2008, the Secretary established the ISR Task Force, headed by the OSD Director, Cost Analysis and Program Evaluation, with broad participation across the department. The ground work done by SOCOM and JRAC led to the identification of the C-12 aircraft equipped with suites of existing ISR equipment, designated MC-12W, as the preferred solution in terms of both timeliness and capabilities. The task force assigned the

acquisition of the MC-12W capability to the Air Force, which in turn gave it to the “Big Safari” rapid acquisition program office.

**IOC**: Not officially established.

First combat mission June 10, 2009. It took less than eight months from funding approval to the delivery of the first aircraft in theater. The entire operational fleet of 30 aircraft was deployed in only 13 months.

“The MC-12W is the fastest weapons system delivered from concept to combat since the P-51 Mustang in World War II. We mobilized a significant industry base and every resource at our disposal, and delivered the first Federal Aviation Administration-certified aircraft in six months and three weeks. It began flying combat sorties in less than eight months.”[54] Nonetheless, it was more than a year between the approval of the requirement and the allocation of funding. This delay seems to have been largely bureaucratic. There was reluctance on the part of service headquarters to accept the urgency of the need. A kick-start from the Secretary of Defense was required to get the urgency addressed. Even after that, it is possible that assets could have been deployed earlier with available contractor assets, operated by either government or contractors. Although that approach was investigated, a procurement of a combination of used and new aircraft was decided on, apparently by the Air Force.

**Scale of acquisition**: Not an MDAP[55] (ACAT not known). Total procurement cost - $548 million, reprogrammed 2008 and 2009 OCO funds. (Research, Development, Test and Evaluation (RDT&E) funding, if any, not known). A total of 37 aircraft were procured at a reported cost of $17 million each (including aircraft and all communications equipment modifications).[56]

**Degree of urgency**: Extremely urgent—one of the highest priorities of the Secretary of Defense to support operations.

**Degree of consensus**: Until Secretary of Defense Gates, there was little support. JRAC pursued based on urgent needs expressed by the Combatant Command, but was unable to enlist much service interest or cooperation.[57]

---

[54] “U.S. Air Force Deploys the Last MC-12 to Afghanistan,” *Defense Update*, July 13, 2013. Quote is attributed to Lt. General David Deptula, then Deputy Chief of Staff of the Air Force.

[55] This means that there are no SARS, which are authoritative sources on MDAP costs, schedule, deliveries, funding, etc.

[56] U.S. Air Force Fact Sheet on MC-12W, found at http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104497/mc-12.aspx.

[57] IDA Research team interview with JRAC personnel.

**Maturity of technology**: Used existing commercial aircraft—both used and new. This was primarily a sensor integration task. Similar aircraft were already in inventory for both Air Force and Army, so support was not a significant obstacle.

**Acquisition approach and outcome**: Available used commercial aircraft and new production commercial aircraft were procured and existing Army-developed ISR equipment was integrated. L3 Communications was selected as the integration contractor. The Air Force delivered the aircraft directly from the factory to the front lines with no developmental or operational testing.

Prior to the establishment of the ISR Task Force, funding was a major issue. Once the project was put under the auspices of the Task Force (which answered directly to the secretary), the necessary funds were identified for reprogramming from the FY2008 and FY2009 supplemental appropriations.

### Lessons Learned

Assets could have probably been deployed earlier using available contractor assets, operated by either government or contractors.[58]

The issues associated with this acquisition were primarily in the requirements and resource prioritization processes. From an acquisition standpoint, the program appears to have been highly successful. That the Combatant Command's urgent request required so much external intervention, despite the high priority, is another lesson regarding inability of the traditional requirements-acquisition process to respond to such emergent needs in an accelerated manner. (However, in this case, the fault lies entirely with the requirements process.) The need for a special OSD-driven Task Force and *ad hoc* funding processes show that even with high priority, the "system" is deficient in addressing such urgent needs, when the military services are reluctant to accept the type of equipment available to meet the need. Since this is a cultural issue in DOD not easily resolved, top management needs to understand it and be prepared for timely intervention when such situations arise.

## G. MQ-1 Predator

**Purpose**: Unmanned Medium Altitude Long-Endurance aerial vehicle for ISR, target acquisition and battle damage assessment (subsequently weapons platform, as well).

**System description**: UAV with a normal operating altitude of 15,000 feet, cruise speed of about 120 kilometers per hour, and flight duration of more than 20 hours. Its

[58] Interview with OSD-JRAC officials.

communications system includes a satellite link to relay images beyond line of sight of its ground control station. System includes ground station for controlling up to four UAVs.

**Date of program initiation**: 1993 (initial contract in 1994)

**Date of first statement of requirement**: Predator was based on a 1993 OSD/Defense Airborne Reconnaissance Office (DARO) "requirement" for tactical ISR—but there was no existing service requirement.

Operation Desert Storm in 1991 highlighted serious deficiencies in airborne tactical-level ISR, particularly for wide-area coverage. The Predator arose out of high-level (Secretary of Defense, Under Secretary of Defense, and Director, Central Intelligence Agency) concerns that these ISR capabilities needed to be kept "affordable" so that sufficient quantities could be acquired. The Predator concept was selected as "Tier II"[59] for medium altitude long endurance ISR.

**IOC**: No documented IOC—Using the ACTD process, first Predators fielded as operational experiment in 1994. SAR lists "Required Assets Available" as of March 2009.

**Scale of acquisition**: The SAR reports a total procurement of 248 systems at a total cost of $3.3 billion.

**Maturity of technologies**: As an aircraft, Predator is not highly complex. The technologies were generally mature. Most of the technology had been developed under DARPA, although with limitations and iterative capabilities. Primary complexities were involved in the control software and in the satellite communications linkage. The operational linkage through the Ground Control Station was also a complicating factor.

The major new development was use of satellite communications. Predator used global positioning satellites (GPS) for navigation, resulting in the first UAV to overcome line-of-sight range limitations through use of satellite technology. Predator used commercial satellite data links for control and imagery transmission. Moreover, the implementation of a tactical ISR UAV in the field was untried beyond their use in classified ISR.

**Degree of urgency**: This was an OSD-driven urgent need to have ISR capabilities to support operations in Bosnia, Iraq, and Afghanistan with emphasis on rapid, flexible, and innovative approaches. With the operations first in Bosnia and then in Iraq, Predator was developed as an urgent program—but not with formal military-service derived requirements.

[59] UAV programs are characterized according to their operating altitude as Tier I (low altitude), Tier II (Medium altitude), or Tier III (high altitude). In addition, a plus sign (+) can be added to denote that the platform is also low-observable (stealthy).

**Degree of consensus**: Support for UAVs was very limited in the military services; their lack of experience with these capabilities made users reluctant to adopt them and they conflicted with other systems and priorities.

**Acquisition approach and outcomes**: Predator was a non-standard accelerated fielding of demonstration systems using the then new ACTD process, which allowed a streamlined management and oversight process, early participation of the user community, and a tight schedule. The Predator demonstrator was delivered for user experimentation in just six months. The goal was to demonstrate military utility in a relatively short timeframe. The use of mature technology was intended to limit risk."[60] Initial funding was through DARO.[61]

The initial Predator ACTD was a prototype system developed and fielded as a demonstrator in 1994. After the ACTD demonstrated its capabilities, Air Force General Jumper strongly supported continuing and expanding the system and its further development. Predator had a Milestone C in August 1997, which authorized the start of LRIP without further development.[62] It was then moved to the Air Force Big Safari program office as a Quick Reaction Capability (QRC) in 1998 and became an Air Force MDAP in 2006.

The airframe was an incremental modification to the General Atomics Gnat-750 UAV—essentially a stretched airframe with longer wings. The initial system comprised an aircraft, sensors, communications capabilities, and a ground control station. Subsequently, a laser target designator and a capability to carry and employ Hellfire missiles was added.

As an ACTD and then through Big Safari, Predator did not go through the formal MDAP acquisition milestones. The ACTD process avoided much of the documentation and milestone processes of mainstream acquisition including any formal pre-stated requirements. Subsequently, Big Safari pursued a tailored acquisition in which many normal assessments and documentation requirements were waived. When it "graduated" to an MDAP in 2006, problems arose regarding the lack of documentation normally required for MDAPs. Some documents were completed quickly, but only 15 of 57 normally required documents were completed before the program itself was completed in 2010.

---

[60] Geoffrey Drezner, et al., *Innovative Management in the DARPA HAE UAV Program*, MR-1054-DARPA, Santa Monica, CA: RAND Corporation, 1999.

[61] DARO was created in 1993 under the USD (AT&L) to provide increased support for airborne reconnaissance systems.

[62] This decision received Congressional criticism. See GAO report GAO/NSIAD-99-4, *Defense Acquisition: Advanced Concept Technology Demonstration Program Can Be Improved*, October 1998, which concluded: "the Predator was rushed into low-rate initial production prematurely given the limited amount of testing conducted at that time and the problems that were uncovered during that limited testing," 21.

The ACTD employed Other Transaction Authority (OTA)[63] to waive almost all traditional acquisition rules and regulations. The result was a tailored program structure with increased contractor design responsibility and management authority.

Predator was successfully employed in Bosnia (just a year after its first flight), Kosovo, and in the no-fly zone in Iraq. Predators were used in Afghanistan—including the use as a weapons platform—despite the fact that they were still prototypes provided to regional combatant commanders on an experimental basis.

The transition of Predator into an Air Force Program of Record, encountered difficulties arising from the lack of documentation, lack of attention given to cost, reliability, maintainability, supportability and lack of agreement on requirements. As stated in one assessment, the Predator

> …raised serious questions about its operational "suitability," a term encompassing maintainability, reliability, safety, and supportability. Early operational assessments conducted by the OSD Director, Operational Test and Evaluation, determined Predator to be deficient in mission reliability, documentation, and pilot training support. Moreover, the tests did not include analysis of system survivability, supportability, target location accuracy, training, or staff requirements. The Air Force was assuming responsibility for what amounted to an undeveloped prototype."[64]

In taking on this acquisition, the Air Force had to undertake considerable additional development—much of it in response to a steady stream of urgent need requests for additional or improved capabilities from the Combatant Commands.

### Lessons learned

> *Note: Because of the many similarities, lessons learned applicable to both Predator and Global Hawk will be presented after the Global Hawk section.*

An assessment of the Predator ACTD raised concerns regarding the ability of such a program to evaluate the system's military utility in an operational assessment.[65] The ACTD approach clearly did not provide the detailed and systemic data collection and assessment in testing and evaluation that is usual for a major acquisition program. Moreover, since the Predator ACTD was a demonstration of an existing platform, it was an off-the-shelf sole-

---

[63] A process allowed by 10 United States Code, Section 2371, to enter into transactions other than contracts, grants or cooperative agreements. It was originally granted by Section 845 of the FY1994 National Defense Authorization Act and is thus sometimes referred to as "Section 845 OTA."

[64] Erhard, p.51. Cites finding from Michael Thirtle, et al., *The Predator ACTD: A Case Study for Transition Planning to the Formal Acquisition Process*, Santa Monica, CA: RAND, 1997.

[65] Thirtle, et al., 36-41.

source procurement, which facilitated the ACTD's aggressive schedule. However, there was little consideration of producibility and cost that are addressed in formal acquisitions.[66]

However, the other side of that coin is that it is unlikely that without the centralized focus of the DARO/DARPA championing of the High Altitude/Long Endurance (HALE) program under strong OSD support using the ACTD process, that either the Predator (or the Global Hawk) would have been pursued by the Air Force, as there was little service interest in such surveillance systems *before* the demonstrations received the attention and support of Combatant Commanders.

The success of the Predator was at the front end of acquisition—at the juncture of the requirements and acquisition processes—where initial alternative concepts were vetted without clear, well-defined requirements in place. In fact, given the novelty of the capabilities, there was no way to have specified such requirements because the users did not know what could or could not be done. The DARPA/DARO concept was to explicitly constrain cost and time to get a potentially useful capability to users for assessment. Predator demonstrated essentially mature technology—the system was a derivative of one that had already been built and employed. The real question was the potential value of such a system in tactical military operations. While the operational environment was real, operational support was strictly *ad hoc*—contractors and developers were in the field with the systems. Moreover, the particular experimentation was limited by time and resources—and became more so as the development schedules and costs ate into the fixed time and dollar budgets.

Predator provides a clear example of a successful demonstration of innovative new capabilities prior to them being identified as military requirements. After this demonstration, the operational community began to demand such novel UAV-based ISR capabilities for use in combat. Through this demonstration, "technology push" became "demand pull" and the Predator spiraled from demonstration to an accelerated quick reaction acquisition, and then to a high profile MDAP. The spiral was spurred by user demand, but also was kept disciplined by OSD and Congressional interests in sustaining the new acquisition processes after the initial demonstration.

Some key lessons from the Predator's development include:

- Initial operational demonstration of a relatively modest new system for a narrow, but important application for which current systems were not capable, permitted Predator to gain a foothold for UAVs where prior efforts were unsuccessful.

---

[66] Thirtle, et al., 41-43.

- While Predator successfully transitioned into an Air Force Program of Record, difficulties arose from the lack of documentation and operational testing and lack of attention given to, reliability, maintainability, and supportability.

## H. RQ-4A/B Global Hawk[67]

**Purpose**: High Altitude Long Endurance Unmanned ISR

**System description**: Unmanned high altitude (60,000 feet) aircraft designed to have (initially) 24-hour loiter time over the target area. Initial RQ-4A (block 10) aircraft were equipped with both electro-optical and infrared sensors and a synthetic aperture radar (SAR) with moving target indicator capability, allowing day/night, all-weather reconnaissance and wide-area coverage (up to 40,000 square nautical miles per day) with low resolution side-looking SAR images, or high resolution spot SAR images. Sensor data is relayed over line-of-sight (X-band) and/or beyond-line-of-sight (Ku-band satellite communications (SATCOM)) data links to its Mission Control Element (MCE).

**Date of program initiation**: 1995 (ACTD); Air Force Program Office established in 1998

**Date of first statement of requirement**: 1993 OSD/DARO "requirement" for tactical ISR**—**but no existing service requirement.

**IOC**: Using ACTD process, the first Global Hawks were fielded as an operational experiment in overseas contingency operations beginning in November 2001. The SAR reflects an IOC for Block 5 of September 2005.

**Scale of acquisition**: Began as ACTD, then transitioned to Air Force first as a Quick Reaction Capability through the Big Safari program, then as separate Air Force ACAT-1D MDAP. It subsequently underwent a major increase in scope. The December 2014 SAR reports a total program cost of $9.0 billion for 45 systems.

**Degree of urgency**: The value and success of initial ACTD-developed Global Hawks deployed to Afghanistan led to accelerated acquisition as an urgent need arose to have ISR capabilities to support expanding operations, with emphasis on rapid, flexible, and innovative approaches.

---

[67] This section derived largely from Richard Van Atta, et al., "Global Hawk," in Richard Van Atta, et al., *Transformation and Transition: DARPA's Role in Fostering an Emerging Revolution in Military Affairs, Volume 2 – Detailed Assessments, Alexandria, VA: Institute for Defense Analyses, Paper P-3698, November 2003* and Gene Porter, et al., *The Major Causes of Cost Growth in Defense Acquisition*, Volume III, Appendix E, Global Hawk, Institute for Defense Analyses, Paper-4531, December 2009.

**Degree of consensus**: Support for UAVs was initially very limited in the services; little experience with these capabilities made users reluctant to adopt them. Global Hawk in particular encountered resistance in the Air Force based on lack of requirements for UAVs for ISR and funding implications.

**Maturity of technologies**: Unlike Predator, Global Hawk required capabilities not previously demonstrated. Software-development and system-integration challenges were underestimated, particularly regarding the difficulty of integrating commercial or off-the-shelf components and subsystems. Advanced radar and advanced signals intelligence and electronic intelligence payloads were under development as separate efforts. The shift in focus immediately after Milestone II to the much larger RQ-4B exacerbated technology readiness with its requirement for "multi-INT"[68] capabilities that resulted in the need to develop a much larger aircraft and also gave rise to significant integration issues.

**Acquisition approach and outcomes**: As previously noted, there are many similarities between Predator and Global Hawk. Both began under the ACTD process at approximately the same time, as highly tailored programs structured for initial demonstration and early fielding. Both initially employed OTA.

DARO sponsored two programs for meeting the Tier II+ and Tier III UAV-based ISR requirements—Global Hawk for Tier II+ and Dark Star for Tier III.[69] They were separate development programs, but were managed together with a Joint Program Office (JPO) under a DARPA program director. Global Hawk was formally designated an ACTD in 1995, and a Memorandum of Understanding with OSD and the three Military Departments was signed in August of that year. The JPO had Air Force and Navy presence from the start (1994) with Army presence starting in 1996. There was a plan to transition the program to the services, and an Air Force System Program Office was established in early FY 1996. Following the signing of the Memorandum of Understanding, a formal oversight committee, chaired by the Deputy Undersecretary for Acquisition and Technology, was established. Transition to the Air Force occurred in late 1998.

A major focus of Global Hawk was on both rapid deployment and affordability, using an evolutionary spiral development strategy for transitioning to an MDAP. DARPA pioneered several new acquisition methods to speed technology transition. Use of OTA allowed DARPA to waive almost all traditional acquisition rules and regulations in favor of a tailored program structure with increased contractor design responsibility and management authority. The Global Hawk program had only one firm constraint: a unit flyaway price (UFP) of $10 million for air vehicles 11–20 (in FY 1994 dollars). All other performance

[68] Multiple intelligence sensors—i.e., employing different sensor technologies on the same platform.

[69] Dark Star was cancelled in January 1999.

characteristics were stated as goals and were supposed to be traded to achieve the target price.

Global Hawk was first deployed, still as an ACTD, in support of Operation Enduring Freedom in Afghanistan with notable success. The method of deployment was unique in that nontraditional crew members, mostly from the test and evaluation community, were used as operators. A turning point in the transition from acquisition to deployment for both Global Hawk and Predator occurred when General Joseph Ralston, commander of the Air Force Air Combat Command, formed an operational UAV squadron. The result was a cadre of Air Force operational and development personnel taking over the program from DARPA. The Air Force subsequently set up a UAV battle lab to explore operational concepts.

The Global Hawk program Milestone II decision in March 2001, at the beginning of the Bush Administration, comported with the initial spiral development strategy for acquiring systems largely derived from the ACTD-developed system (particularly as single-INT systems using available sensors). However, a few months after the Milestone II decision, the Air Force decided upon a Multi-INT aircraft combining both imagery intelligence (IMINT) and signal intelligence (SIGINT) sensors on the same platform, as well as accelerating more advanced, less mature, IMINT sensors. The result was that the Global Hawk payload requirement grew from 2,000 to 3,000 pounds, which in turn required a much larger airframe. This system, the RQ-4B, was initially presented as being 80% common with its predecessor, but was instead essentially a new, substantially larger aircraft and a much more complex overall system. In the end, approximately 10%-20% commonality was attained, as the RQ-4B "required a new wing, radome and landing gear, a longer tail, extended fuselage, a longer nose, and more electrical power."[70]

**Cost and schedule**: The design and development programs for Global Hawk were based originally on a philosophy of "cost as an independent variable (CAIV)," meaning that cost objectives are to be taken as a constraint on performance and schedule—versus the traditional DOD focus on system performance. For Global Hawk, DOD told Congress that unit cost was the only firm requirement:[71]

> The contractors are being driven to a $10 million UFP requirement, and all other system attributes, including performance, are traded off against this requirement…[T]he intent is to arrive at a system solution which is not the best we can imagine but rather good enough to do the job.

[70] Gene Porter, et al., *The Major Causes of Cost Growth in Defense Acquisition*, E-16.

[71] Richard Van Atta, et al., "Unmanned Aerial Vehicles," in Richard Van Atta, et al., Transformation and Transition, Vol II, p. VI-32. See also Geoffrey Sommer, et al., The Global Hawk Unmanned Aerial Vehicle Acquisition Process, A Summary of Phase I Experience, Santa Monica, Calif.: RAND, MR-809-DARPA, 1997, 17-18.

However, technical problems affected both cost and schedule in the program. Software and payload development problems resulted in a program delay of more than a year. These program delays translated into increases in cost of development, leading in April 1997 to a limit of producing five Global Hawk prototypes. Additionally, the demonstration program was reduced from the original 24-month period to 15 (and later 12) months.

All of this was done to accommodate the position of the Under Secretary of Defense for Acquisition and Technology that no further funds were available to increase the program's bottom line. This change in program content had a significant effect on the UFP, which was estimated to have risen to about $14 million. The Government Accountability Office (GOA) subsequently estimated that the UFP for the Global Hawk was averaging $15.3 million in 1994 dollars and might climb even higher before the program reached its completion, since this number assumed no additional changes to the aircraft and higher annual production rates than the DOD planned.

A RAND assessment[72] noted that while the program had a "firm" UFP requirement of $10 million, this was not maintained—in fact, within a relatively short time, it had escalated by 50 percent and would increase much more. One underlying problem for Global Hawk was an ambiguous definition of military utility that made both the government and the contractors reluctant to drop functionality to maintain UFP. This will be examined further under the discussion below of "requirements."

The program resulted in early operational capabilities. The initial demonstration capabilities had operational value and demonstrated to operational commanders the potentially greater value of such systems. However, considerable additional investments were needed when Global Hawk became an actual acquisition program.

The RAND assessment noted that the HALE ACTD cost and schedule constraints "may have resulted in an accelerated program structure that may have left insufficient time to determine military utility."[73] However, without the centralized focus of the DARO/DARPA championing of the HALE programs with strong OSD leadership support, it is unlikely that the Global Hawk would have been pursued by the Air Force, since there was little Air Force interest in such surveillance systems before the demonstrations received the attention and support of Combatant Commanders.

The original purpose of the ACTD was to test the concept that "affordable" unmanned endurance was both possible and of value. To achieve this test, it was deemed necessary to go beyond prototyping and get actual capabilities into military operations. It was accepted

---

[72] Jeffrey Drezner, et al., *Innovative Management in the DARPA High Altitude Endurance Unmanned Aerial Vehicle Program*, MR-1054-DARPA, Santa Monica, CA: RAND, 1999, 58.

[73] RAND, Op Cit, page xvii

that the systems being fielded through this process would be first attempts at the needed capabilities that would be modified iteratively in response to how well they performed and the users' responses to them.

**Transition to MDAP**: The Air Force made a fundamental shift in the Global Hawk program (with OSD approval) after the program went through the Milestone II decision process and the completion of a new requirements study which had been in progress. The transition from ACTD to MDAP clearly was inconsistent with the initial concept of an evolutionary spiral development and acquisition with affordability as a major driver. The shift *after* Milestone II was to a new, much larger and more complex system with advanced Multi-INT, versus off-the-shelf single-INT sensor capabilities.[74] That in turn resulted in a change of approach from the evolutionary spiral strategy to a much more ambitious, time-compressed program with concurrent development of the new larger aircraft and the new more advanced sensor systems—in all, three different configurations of the RQ-4B. Another complication of this shift was the program office having to concurrently oversee continuing procurement of the existing RQ-4A block 10, while supporting urgent ongoing operational demands of the Combatant Commander. These changes and complexities led to major issues concerning cost and schedule growth with the RQ-4B. The initial estimates were highly optimistic based on faulty assumptions. The reality was that the UFP for the system ended up at nearly $100 million by 2009.

### Lessons Learned

The initial ACTD system and the subsequent acquisition as RQ-4A were clearly successful with deployment to Afghanistan in late 2001 to meet urgent operational needs. The 2006 Quadrennial Defense Review explicitly called for doubling production rates of ISR UAVs, including Global Hawk. By 2009, Global Hawks had logged over 25,000 flight hours. However, this early success has been countered by subsequent acquisition problems when the system transitioned to the Air Force as an MDAP.

Looking at the eventual costs for the Global Hawks today, the initial costs are astonishingly low. However, it is clear that the costs today are for an entirely different, substantially larger family of systems for a different mission set. What has been gained in mission capabilities with the relatively unconstrained current Global Hawk has come at the cost of nearly 10 times the envisioned system. Whether the benefits obtained are worth those costs has not be determined. However for better or for worse, the idea of a relatively

[74] Gene Porter, et al., *The Major Causes of Cost Growth in Defense Acquisition*, E-11-12 and Jeffrey Drezner and Robert Leonard, *Global Hawk and Dark Star: Transitions Within and Out of the HAE UAV ACTD Program*, Santa Monica, CA: RAND, 2002, 34-36.

"affordable" high altitude-long endurance tactical reconnaissance capability appears to have been lost in the process.

The RAND study made a particularly focused recommendation regarding the use of the ACTD-type of accelerated acquisition—the necessity to provide for more latitude in trading off cost (in this case the UFP) and time against performance. In essence, their view was that the Global Hawk ACTD was overly driven by cost limitations that allowed insufficient ability of users and developers to add capabilities to achieve value. "Cost, schedule, and performance can all be goals to be traded against each other to achieve an optimal solution for the military mission. Programs can set boundaries for cost, schedule, and performance parameters, but the resulting trade space must be large enough to enable realistic and credible tradeoffs."[75] While this observation is certainly reasonable, it does open up the aperture for escalating costs and increasing schedules that have plagued many major systems developments. Indeed, even with these constraints, the Global Hawk flyaway costs for the demo systems grew by more than 50 percent.

Although Global Hawk was inserted into the actual operational environment, the means of supporting the experiment in the field was not that of an actual operational environment—contractors and developers were in the field with the systems. Moreover, the particular experimentation was limited by time and resources—and became more so as the development schedules and costs ate into the fixed time and dollar budgets.

While the initial Global Hawk was successful as a deployed operational demonstration that proved highly useful in supporting U.S forces in the Middle East conflicts, its subsequent transition as an MDAP was much more convoluted than that of the Predator. Some reasons include:

- It was considerably more risky technologically than Predator.
- It had less support as an operational system for tactical ISR by the Air Force.
- It had a much less distinct mission and was seen as competing with other unmanned and manned systems, such as U-2.
- Air Force came to see Global Hawk as an alternative for strategic-level ISR as a U-2 replacement—essentially redirecting it toward a different mission.
- Higher-level support for the initial Global Hawk as an "affordable" HALE ISR asset waned with change of administrations.

---

[75] Jeffrey Drezner, et al., *Innovative management in the DARPA High Altitude Endurance Unmanned Aerial Vehicle Program,* MR-1054-DARPA, Santa Monica, CA: RAND, 1999, 132.

- With transition to MDAP and re-focusing on a different mission, and essentially a new system with minimal commonality with the initial system, there were fundamental underestimations of costs and schedule.

Global Hawk shows that new concepts can be developed and operationally demonstrated for assessment and to gain the interest and support of military users. The approach clearly provided a mechanism to foster and accelerate innovation. However, the transition from ACTD to MDAP demonstrated that stakeholder perspectives on how to implement innovative concepts can vary widely. Simply put, the Air Force had not bought into the concept of an "affordable," "single-INT" HALE UAV, and redirected the program to its priorities. When that happened, the Global Hawk became much more of a standard MDAP, and performance priorities were emphasized over both time and cost.

**Lessons Learned Applicable to both Predator and Global Hawk**

In retrospect, the development, demonstration and fielding of two unmanned endurance surveillance and reconnaissance aerial vehicles can be viewed as successful. First and foremost, these two major new systems were put into operational use and proved to be of considerable value. Both programs resulted in initial early operational capabilities supporting actual combat operations. These capabilities were fielded through aggressive programs that took on the "normal" processes of weapon systems development and acquisition with novel organizational structures and processes. Importantly, these programs succeeded where other UAV efforts had not. Prior programs ended in failed acquisitions with skyrocketing costs and delays. Early attempts at acquiring such capabilities in the 1980s became expensive as developers loaded on capabilities to meet wish lists from others.[76]

Organizationally, the UAV programs broke new ground with the creation of an entirely new organization, DARO, to manage all airborne reconnaissance. The use of the DARPA-created OTA process for engaging the system developers provided a novel and unproven development approach that waived much of the traditional defense contracting processes and procedures and placed the performers in a unique position relative to the government. The use of Section 845 OTA as a means to develop both Predator and Global Hawk demonstrations facilitated the program offices and the contractors with a more flexible management process, which for the demonstration programs proved to be a useful mechanism. However, subsequent use in other acquisition programs has proven to be more problematic.

Of paramount importance was the fact that these systems met compelling needs which could not be met with existing systems, and the systems were able to evolve to meet

[76] See Erhard, 2010.

subsequent emerging needs. Their successful evolution from demonstration to fielded systems provide an example of accelerated, but evolutionary acquisition that may be highly relevant for evolving innovative future defense systems, such as the Navy's UCLASS[77] unmanned aircraft program.

This success was at the front end of acquisition—specifically pre-acquisition—where initial alternative concepts were vetted without clear, well-defined requirements in place. In fact, given the novelty of the capabilities, there was no way to have such requirements because the users did not know what could or could not be done. Early attempts at acquiring such capabilities had been massively expensive, as developers loaded on capabilities to meet wish lists from others. The DARPA/DARO concept was to explicitly constrain cost and time to get a potentially useful capability to users for assessment.

Some key lessons include:

- Through accelerated demonstration and acquisition approaches, Predator and Global Hawk met compelling needs for which there were no existing systems and were able to evolve to meet additional needs as they were identified.
- Prior development and maturation of new concepts and technology by DARPA facilitated the ability to demonstrate a new capability in an operational environment.
- The ACTD process garnered increased user community support through demonstration and deployment, and led to identification of areas for improvement as well.
- Use of novel, non-standard approaches for development and initial acquisition allowed rapid implementation to meet pressing user needs.
- Strong high-level (OSD) support for both the demonstration and deployment of novel defense capabilities outside of standard processes of the military services were crucial for this new system to gain traction.

## I. MQ-9 Reaper

**Purpose**: Medium endurance unmanned ISR, target acquisition, and strike aircraft to provide greater capabilities than its predecessor, the MQ-1 Predator.

**System description**: A hunter/killer UAV derived from Predator. Larger, heavier, and more capable than Predator; it can be controlled by the same ground systems. The Reaper has

[77] Unmanned Carrier-Launched Airborne Surveillance and Strike

a 950-shaft-horsepower (712 kW) Honeywell (Formerly AlliedSignal) turboprop engine, compared to the Predator's 115 hp (86 kW) piston engine. The power increase allows the Reaper to carry 15 times more ordnance payload and cruise at almost three times the speed of the MQ-1.[78] The aircraft is monitored and controlled by aircrew in the Ground Control Station (GCS), including weapons employment.

**Date of program initiation**: 1999—contractor initiated, 2000—NASA[79] support, 2002—QRC under Air Force Big Safari.

**Date of first statement of requirement**: Not identified specifically—there was a clear operational need for longer distance, more robust version of Predator for Afghan operations in 2000.

**IOC**: With the imperative of operational needs, combat operations began November 2007 while the system was still in development. The Dec. 2015 SAR reflects a Required Assets Available date of June 2012.

**Scale of acquisition:** The December 2015 SAR reports a total program cost (past and projected) of $12.0 billion for 350 systems, of which 207 systems had been delivered.

**Degree of urgency**: This was an operationally-driven urgent need to have strike capabilities to support current operations with emphasis on early fielding.

**Degree of consensus**: With the success of Predator, the value of the larger weaponized Reaper was generally supported by the Combatant Commands and the Air Force.

**Maturity of technologies**: The contractor had demonstrated the new (but relatively mature) technology as a prototype, but Reaper was a significant scale-up in size from Predator, which as seen in Global Hawk can cause difficulties. In this case, the process seems to have been smoother (perhaps a consequence of the Global Hawk experience). Still, considerable development beyond the prototype system was needed for a more robust and capable system. There were operational demands for additional capabilities, such as extending the operating range and more capable software, proved to be challenging.

**Acquisition approach and outcomes**: Air Force initiated the Reaper acquisition under Big Safari in 2002. A contractor-developed prototype was acquired as a QRC. The acquisition was then placed under the Predator program in 2006, and transitioned in 2008 to a separate MDAP.

---

[78] General Atomics, MQ-9 Reaper/Predator B, www.ga-asi.com/predator-b and fact sheet http://www.ga-asi.com/Websites/gaasi/images/products/aircraft_systems/pdf/MQ9%20Reaper_Predator_B_032515.pdf

[79] National Aeronautics and Space Administration

General Atomics Aeronautical Systems, the developer of the Predator, pursued a larger aircraft with greater capabilities, initially as an internal development. The Predator B, later designated the MQ-9, was first developed by General Atomics as an Independent Research and Development effort.[80] It then became an Air Force program in response to urgent warfighter needs. As a follow-on to the MQ-1 Predator, it is substantially larger, has considerably more capability including the capacity to carry up to 16 Hellfire missiles (compared to the Predator's two), or a mix of smaller missiles and bombs.

General Atomics began development in 1999 of the "Predator B-001," a proof-of-concept aircraft, which first flew in February 2001. NASA began to jointly fund this development in January 2000 as part of the Environmental Research Aircraft and Sensor Technology program.[81] It had an airframe based on Predator, except with an enlarged fuselage and wings lengthened from 48 feet to 66 feet. Subsequently, the company refined the design with a jet-powered version—"Predator B-002." The Air Force reportedly ordered two airframes for evaluation, apparently the initial NASA prototypes.[82] The first two airframes delivered were the prototypes B-001 and B-002.[83] The Air Force evaluated the Predator-B prototypes for use in Afghanistan since the Predator MQ-1s had problems in flying from Tajikistan over high mountains and there were several losses.

A contract to procure aircraft for the Predator System Squadron was awarded in March 2006, with 256 Predators and 126 Reapers to be acquired under sole source procurement to General Atomics, from 2006 to 2012. The sole-source justification cited requirements for Global War on Terror contingency operations, as well as new customer requirements, including Air Force Special Operations Command necessitating "significantly increased production volumes."[84] Given the imperative of operational needs, MQ-9 combat operations began November 2007 while the system was still in development. "This early fielding of the MQ-9 before completion of the Increment I development program resulted in concurrent development, production and sustainment."[85] While General Atomics had basic production capabilities, the need for a production surge outstripped production capacity leading to slippage in an aggressive schedule.

---

[80] Acquisition Strategy for MQ-9 Unmanned Aircraft System (UAS), 25 January 2012.

[81] Altair, NASA, http://www.nasa.gov/sites/default/files/atoms/files/fs-073-afrc.pdf

[82] IDA Research Team Interview with Dyke Weatherington, October 7, 2015.

[83] B-002 was originally equipped with the FJ-44 engine but that was removed and a turboprop was installed so that the USAF could take delivery of two aircraft in the same configuration.

[84] "Justification and Approval for Other Than Full and Open Competition for the Predator Program", Air Force Material Command, dated July 14, 2006, as reported in Dan Gettinger, "Drone Spending: the MQ-9 Reaper," Center for the Study of the Drone, Bard College, October 12, 2015.

[85] Acquisition Strategy for MQ-9 Unmanned Aircraft System (UAS), 25 January 2012.

Procurement began as a sole source QRC before transitioning to an MDAP. Explicit language in the 2008 National Defense Authorization Act (NDAA) emphasized that Reaper should proceed with lean acquisition processes similar to those used by Big Safari. Moreover, the urgency of demand, supported by Congressional involvement, significantly accelerated the production, leading to flexible contracts but also creating uncertainty in outyear buys.[86] Thus, LRIP continued much longer than the usual 10 percent of total production because of the Congressionally-directed surge, and will result in some 63 percent of planned procurement.

In FY 2008 the MQ-9 Reaper was established as a separate program, designated by the USD (AT&L) as a Special Interest Program in January 2009 and an ACAT ID program in July 2009.[87] The MQ-9 Reaper program was broken into two blocks designated Block 1 and Block 5. Block 1 aircraft were to provide the initial capability to meet the early fielding directed by Congress and Block 5 aircraft were "significant improvements in the Block 1 that includes both hardware and software enhancements…" The Reaper program reached Milestone B in February 2004 and Milestone C for Block 1 in February 2008. Milestone C for the Reaper Increment I, Block 5 was approved on November 21, 2012. The program procured 200 Block 1 aircraft prior to Congressional direction to procure 204 Block 5 aircraft starting in FY 2013. Initial funding came from QRC and OCO funds and thus there were no issues.

The Reaper program succeeded in "spiraling" a substantially more capable system that met emergent needs for an aircraft with much greater range and delivery of greater strike capability. The initial corporate development by General Atomics was not explicitly driven by a known threat. But, when the problem arose in reaching Afghan targets from Tajikistan, the Air Force quickly acquired the two existing Predator Bs and funded its further development through its QRC. These were rapidly developed and deployed to theater and the development and deployment continued iteratively with 200 aircraft delivered along with related ground control stations.

As a rapid response to ongoing combat operations, the Reaper program was stressed by demands from the theater. This is clearly stated in a recent internal paper on Program Management Assessments from the Office of the USD (AT&L):[88]

---

[86] Acquisition Strategy FOR MQ-9 Unmanned Aircraft System (UAS), 25 January 2012.

[87] Acquisition Strategy FOR MQ-9 Unmanned Aircraft System (UAS), 25 January 2012.

[88] Col William S. Leister, "MQ-9 Reaper Unmanned Aircraft System," Compendium of Annual Program Manager Assessments for 2015, Office of the Under Secretary of Defense, Acquisition, Technology, and Logistics, September 23, 2015.

> The [operational] demand signal for additional assets with an ever-changing array of advanced capabilities continued to increase throughout this period. Keeping pace with this demand signal while attempting to shift to a more traditional acquisition program construct and sustaining a non-homogeneous fleet proved to be a challenging task for the program office.

The program manager also noted that latent issues emanating from accelerated development still haunt the program. For example, the loss of an aircraft revealed flawed logic in the autopilot software, a catastrophic fault that was present since program development. He further notes that the program continues to have to manage identified hardware- and software-related risk areas. In addition, turbulence in requirements and shortages in the program office staff have had significant impacts.

As noted in the Reaper Acquisition Strategy document, software development became particularly stressed, especially with a steady stream of demands coming from the operators in the field:

> It currently takes almost two years to develop, test and field a new software "build." Consequently, …there are at least three software builds underway at any given time. The testing, particularly flight testing, required to develop and field software has become the principal chokepoint for the program and a major cost, schedule and performance driver." Moreover, "individual software builds and delay elements of the program of record, "special" users under the aegis of Special Projects and Big Safari require development of unique software side branches that take priority over or reallocate resources required to develop the program of record software.[89]

**Lessons Learned**

Reaper has been a notably successful new system derived from the preceding Predator. From the outset, Reaper was a spiral development first as a contractor initiated augmentation of the Predator A, then as a QRC to support urgent needs in Afghanistan, which then was merged into the Predator program and then subsequently spun out as its own MDAP. Throughout this process, Reaper development and acquisition benefited from, but had to accommodate, heavy demands from the Combat Commands for rapidly delivering these systems, but also for a near-constant demand for improved capabilities to meet operational needs. This stressed program office capabilities and resulted in various aspects of the standard acquisition process not being fully conducted—such as program documentation and planning. One significant result of the Reaper acquisition, as a legacy of its spiral development from a QRC response, is that it was a sole-source development. Given the fact that the original concept for the initial Predator was contractor developed and that the

[89] Acquisition Strategy FOR MQ-9 Unmanned Aircraft System (UAS), 25 January 2012, 5.

subsequent Predator-B was as well, that should be no surprise. However, it does raise questions on DOD acquisition strategy under such circumstances. One aspect is the ability to provide the follow-on support of such systems when the intellectual property resides largely with the contractor.

Growing pains at General Atomics in meeting the escalating demands for this new system are another aspect of this acquisition. They can be attributed to the stresses noted above from the intense demand and highly accelerated development and acquisition related to the ongoing conflict. Additionally, while derived from the original Predator, Reaper entailed a considerable leap in technical capabilities to meet the expanded demands, which had to be developed and integrated rapidly. While a more deliberate process likely would have reduced the stress and subsequent need for fixes in the field, the Reaper provided a valuable operational capability that continues to contribute greatly to U.S. operations in Afghanistan, Iraq, and elsewhere.

Some key lessons include:

- Exemplifies the potential of contractor-initiated innovation.
- Spiral development and acquisition provided valuable new capabilities to operational forces in a highly responsive manner.
    - However, the highly responsive, operationally-driven program stressed both the program office and the contractor and resulted in (1) problems with reliability, operational use, and downstream support; and (2) deficiencies in documentation, planning, and sustainment.
- A distinct mission that did not compete with other unmanned or manned systems, and thus received continued support from both the Air Force and the operational commands.
- Development and acquisition largely driven and supported by conflict imperatives, which justified and allowed for use of non-standard processes that facilitated accelerated development and acquisition and provided access to funds.

## J. WIN-T Increment 1

**Purpose**: Provide broadband and satellite communications for Army tactical units.

**System description**: A communications network that employs commercial satellite and commercial internet networking technologies to provide Army forces with a state-of-the-art communications backbone to enable exchange of information (voice, data, and video) at high speeds with high reliability throughout the tactical division, brigade, and battalion levels. The system utilizes either commercial Ku or military or commercial Ka band satellite communications, and provides interfaces to lower-level systems. The required antenna size for Ku band satellites means that maneuver units have to stop moving to deploy the satellite

antennas. Thus, the system provides what the Army describes as “at the halt” communications capabilities, which is considered a significant tactical limitation.[90]

The basic WIN-T program had an initial SAR in 2003. In 2007 the program incurred a critical Nunn-McCurdy breech. After a re-assessment of the program in light of the breech, the USD (AT&L) directed a restructuring which significantly changed both content and schedule by dividing the program into three increments, each of which were designated as MDAPs. Furthermore, an existing non-MDAP Army acquisition program, the Joint Network Node-Network (JNN-N) was incorporated into WIN-T Increment 1a.[91] In addition, Increment 1a added Ka military[92] or commercial satellite capability to JNN-N. Increment 1b included additional and compatible capabilities, providing a much broader spectrum of information services than legacy C3 systems, including video/multimedia, graphics data, imagery, collaborative planning tools, and one common network picture. Increment 1b achieved those capabilities via technology insertions from the WIN-T Increment 2 program by introducing the “network centric waveform,” a dynamic waveform that optimizes bandwidth and satellite utilization, and. “colorless core Information Assurance (IA) architecture,” which further enhances security.[93]

**Date of program initiation**: 2002—for the earlier JNN-N program, which was incorporated in 2007 into the existing WIN-T program under WIN-T Increment 1

**Date of first statement of requirement**: The original WIN-T program was based on requirements documents dating from 1998. An initial requirements document for JNN-N has not been located; a later document that was located is the “Bridge to the Future” Capabilities Production Document, August. 2006.

**IOC**: JNN-N began fielding in 2004 and completed fielding in 2012.[94] The WIN-T Increment 1a first unit equipped was fielded in October 2008, and was the unit used for Initial Operational Test and Evaluation (IOT&E).

The first JNN-Ns were delivered in August 2004 to the 3rd Infantry Division for training prior to its return to Iraq. There was no formal testing of the equipment, but based on successful integration and user acceptance, a decision was made to equip other deploying brigades on an incremental basis. Thus, by September of 2005, the Army announced plans to deliver JNN-Ns to the 101st Airborne Division, the 4th Infantry Division, and the 10th

---

[90] An “on the move” capability is one of the objectives of the WIN-T Increment 2 program.

[91] By that time, the JNN-N program had exceeded MDAP funding thresholds.

[92] For example, the DOD Wideband Global Satellite system.

[93] This cryptographic architecture provides compliance with the DoD Global Information Grid.

[94] Source: Army PEO C3T website.

Mountain Division. Because of the incremental nature of the acquisition, the Army did not identify the program as an MDAP, despite it becoming apparent that MDAP funding criteria would be met.

**Scale of acquisition**: MDAP. When a Nunn-McCurdy breach occurred in the then-existing WIN-T program (which was already an MDAP, now called "Increment 2"), and after review of the entire program, the USD(AT&L) directed the Army to incorporate JNN-N into a separate MDAP named WIN-T Increment 1. The last SAR for the program WIN-T Increment 1 in December 2011 reflects a total program cost of $4,222 million for 1,860 sets.

**Degree of urgency**: This was an urgent need for deploying forces since existing equipment was obsolete and deficient in numerous ways. The previous "mobile subscriber equipment" (MSE) was based on cellular communications technology and depended on the erection of relay towers for line-of-sight communications among users. That system proved highly inadequate for fast-moving operations in the early stages of the 2003 Gulf War.

**Degree of consensus**: Wide

**Acquisition approach and outcomes**: Largely a purchase and integration of commercial equipment. The Army modified existing contracts for MSE and other communications and network equipment to rapidly procure the COTS (commercial off the shelf) components. Waivers were required to purchase equipment using several sole-source contracts for various components, which entailed taking some risks, since protests were inevitable. The approach was justified by the urgency of the need to support ongoing operations. An evolutionary approach was taken, in that each delivery lot was an improvement. Earlier sets were backfitted to the extent possible.

The WIN-T program utilized a three-pronged approach to acquisition. SATCOM systems were acquired utilizing one contract vehicle, while the network hardware and transit cases were procured under another. Systems engineering, integration, training, documentation, and logistics support were provided initially via engineering change proposals to another existing MSE contract and, after incorporation of the program into WIN-T, via a competitive award to General Dynamics. Utilizing existing contracts sped up the acquisition process and leveraged the existing logistics support infrastructure.

**Maturity of technologies**: Technology incorporated for use in the initial JNN networks was readily available COTS. Particularly successful was the internet protocol network architecture. Another success was achieving backward interoperability with the retained components of the MSE network. There were initial challenges for some of the technologies to configure them to support the unique network architecture required by the Army. For example, the SATCOM network, when deployed, was the first instance of that network at such a large density of nodes. The deployed number of nodes was approximately five to six times greater than any previous deployment and required a different network control configuration than previously used. No new hardware or software development was

necessary to overcome the issue. Another example of a unique challenge was achieving wide-area-network acceleration and optimization. There were no commercial industry accelerators that easily supported the JNN SATCOM-based network design, and the products available from the vendor required intensive manual configuration. The solution was to acquire network accelerators from a different vendor that configured themselves dynamically during fielding.

After a decision to proceed, Army systems engineers spent six months designing and engineering the details behind the JNN network. JNN-N was procured, configured, and fielded to the 3rd Infantry Division in less than 180 days after the availability of funding. The success of the acquisition is confirmed by the Army's decision to equip subsequent deploying brigades with JNN-N.

**Lessons Learned**

If requirements are molded to be consistent with readily available commercial equipment, a rapid acquisition of critical needs is possible. The acquisition and contracting processes have sufficient flexibility, if fully exploited, to support such acquisitions. However, some of the contracting shortcuts taken in the JNN-N acquisition might not be possible to justify in the case of non-urgent needs. A second lesson learned is that COTS products can bring great capability to the military forces and can be fielded quickly. However, COTS products may engender obsolescence and supportability issues because components and parts may not always be easily identified and monitored for obsolescence.

## K. Future Combat System (FCS)

**Purpose**: Provide the capabilities of a heavy combat brigade that is substantially lighter and smaller, and thus more easily and quickly deployable by replacing the vehicles and C3 systems in heavy armored units with a completely "transformed" system.

**System description**: Not really an acquisition system in the traditional sense, rather FCS was a "system of systems" comprising multiple armored, manned ground vehicles, unmanned ground vehicles, UAVs, unattended ground sensors, and associated network for communications, command and control. One unusual characteristic of the program was that the Army would add or remove (mostly the latter) various systems to or from the overall FCS umbrella over time, making cost and schedule virtually impossible to track meaningfully.

FCS was a virtually complete replacement of the combat vehicles and C4ISR[95] components of Army heavy brigades, comprising a network for command, control, and communications; unattended ground sensors (UGS); UAVs; unmanned ground vehicles

[95] Communications, Command and Control and Computers, Intelligence, Surveillance and Reconnaissance.

(UGVs); and eight manned ground vehicles, including a new much lighter (28 tons) mounted combat vehicle to replace the M-1Abrams tank and a new much lighter (29.6 tons) infantry carrier to replace the Bradley infantry fighting vehicle. The envisioned network depended heavily on two communications systems being concurrently developed in separate MDAPs—the Joint Tactical Radio System-Ground Mobile Radio (JTRS-GMR) and the WIN-T Increments 2 and 3. Both of those programs, especially JTRS-GMR, faced serious technical issues (JTRS-GMR was cancelled soon after the cancellation of FCS.).

**Date of program initiation**: In February 2000 Army entered into an agreement with DARPA for Concept Technology Development. Milestone II for the very immature program was held November 2000.

**IOC**: Initially program was to have an IOC in FY 2012; Program was cancelled in 2009—no actual fielding occurred.

**Scale of acquisition:** The last SAR for FCS (December 2007) reflected a total projected program cost of $159.3 billion for 14 brigade sets.[96] It reported total "prior year spending" of $11.4 billion with another $3.4 billion being requested for FY2008. How much of those funds were actually appropriated and obligated prior to program cancellation in December 2009 has not reported. A 2011 Army report states sunk costs as $19.0 billion.[97] This figure does not include related separate programs, such as JTRS-GMR, whose purpose was largely to support FCS.

**Date of first statement of requirement**: The Army's extremely slow deployment of a heavy brigade from Germany to Kosovo in the spring of 1999 convinced the Chief of Staff, General Eric Shinseki, that the Army's armored brigades needed to be far lighter and more easily transported to theaters of operation. Deficiencies in the level of protection in comparison to existing units were to be compensated for by a quantum leap in communications networking so that battlefield information could be immediately shared by all vehicles in a unit and at all levels of command.

General Eric Shinseki outlined the key requirements that became FCS in a December 1999 speech:

> With the right technological solutions, we intend to transform the Army, all components, into a standard design with inter-netted C4ISR packages that allow us to put a combat capable brigade anywhere in the world in 96 hours

---

[96] Reportedly the largest Army acquisition program in history in Frances Lussier, *Analysis of the Army's Transformation Programs and Possible Alternatives*, Washington, D.C.: Congressional Budget Office, June 2009, 11.

[97] *Army Strong: Equipped, Trained and Ready, Final Report of the 2010 Army Acquisition Review*, Department of the Army, January 2011. (Known as the Decker-Wagner report).

> once we have received execute liftoff, a division on the ground in 120 hours, and five divisions in 30 days.[98]

A Mission Needs Statement followed shortly in January 2000.

**Degree of urgency**: While the Army identified the program as an urgent need, the degree of urgency of that requirement can be questioned—arguably, the need existed for a long time.

**Degree of consensus**: While General Shinseki and some in OSD strongly backed this "transformational" effort, many within the Army and outside thought the program was unrealistic. However, any Army-internal objections to the concept and plan were overcome by top down insistence of the necessity for a rapid replacement of the heavy armored brigades with a more expeditionary capability.

**Maturity of technologies**: Key technologies were *not* mature at Milestone B (in contradiction to policy[99]). Performance objectives were unachievable for both the vehicle (weight, protection, and combat effectiveness) and the network. The envisioned "mobile ad hoc network" was said by experts to be in defiance of the laws of physics in terms of nodes and bandwidth. Robotics technologies were unachievable in the reduced timeframe.

**Acquisition approach and outcomes**: The Army took a unique approach to this program soon after it was conceived by entering into a cooperative technology development program with DARPA. The joint Army-DARPA approach was to use OTAs in the "Concept and Technology Development" phase (roughly equivalent to the Technology Maturation and Risk Reduction phase in the current DOD acquisition process); however, there was neither a Materiel Development Decision nor a Milestone A.

The Army employed a dual contractor team (Boeing and SAIC) under a "Lead Systems Integration" contract for "collaborative" industry/government overall management of the program, resulting in most of the key oversight responsibilities falling to the contractor team (an implicit admission that the Army lacked the technical expertise and resources to manage a program of unparalleled complexity). This arrangement ultimately proved to be highly problematic.

The program faced overwhelming technical challenges, cost increases, and schedule delays, leading to its eventual cancellation. Congress repeatedly reduced funds as technical challenges emerged.

---

[98] Shinseki, Eric K., Address to the Eisenhower Luncheon, 45th Annual Meeting of the Association of the United States Army, October 12, 1999.

[99] Porter, et al. IDA Paper P-4531, D-7.

The Army attempted to salvage some of the technology developed in FCS for other programs, apparently without much success. Secretary Gates, upon canceling the program, stated that some of the freed-up funds would be rolled into overall Army combat vehicle modernization. One such use was the Ground Combat Vehicle program, which itself was cancelled (due primarily to affordability) before it reached Milestone B. The Armored Multipurpose Vehicle (AMPV) program to replace the M113 personnel carrier is still ongoing; it passed Milestone B in 2014.

**Lessons Learned**

The Army concept of operations for FCS was compromised by an overreliance on assumptions that the acquisition community could develop and integrate items using both evolutionary and unknown revolutionary technologies. In addition, there were extremely optimistic expectations that unprecedented and technically under-analyzed deployability, ISR, and intelligence fusion capabilities would be achieved. There seemed to have been a lack of understanding by Army and OSD decision-makers regarding how much the program relied on such critical, high-risk assumptions. The two most important capabilities—C-130 transportability and real-time, tactical intelligence—had the weakest technical bases.[100]

There were fundamental problems with the statement of requirements for the FCS. Because many of the technologies were underdeveloped and immature, those responsible for setting requirements let key requirements remain flexible and did not insert threshold values in the first version of the Operational Requirements Document. The lack of firm requirements created problems for engineers as they began developing design solutions for requirements that remained unsettled and continued to change in major ways more than two years after Milestone B.[101]

FCS is an example of over ambition out stripping technological realities. That was compounded by the insistence by the Army Chief of Staff that the development of this extremely complex system of systems be accelerated to meet his goals. Assessment of the FCS in IDA's study of *Major Causes of Cost Growth in Defense Acquisition* identified as key factors driving FCS cancellation: massive cost and schedule growth, extremely unrealistic assumptions regarding what could be accomplished, and weak management and oversight.[102] FCS was rushed into engineering development without the appropriate early systems engineering and analyses. FCS is one of the more egregious examples of (1) not

---

[100] Pernin, C. G, et al., *Lessons from the Army's Future Combat Systems Program*, Santa Monica, CA: RAND, 2012.

[101] Ibid.

[102] Gene Porter, et al., *The Major Causes of Cost Growth in Defense Acquisition*, Volume II: Main Body, IDA Paper P-4531, Alexandria, VA: Institute for Defense Analyses, December 2009.

ensuring that the requirements for the program were well understood and firm; and (2) not ensuring that the technologies critical to successful development and production were sufficiently mature.[103]

## L. Littoral Combat Ship (LCS)

**Purpose**: A fast, agile, and networked naval surface combatant optimized for littoral naval combat.

**System description**: There are two classes of LCSs, based on competing designs, but both designs were based originally on commercial ferry-type vessels. The original concept was for small, fast, affordable ships that could be configured to carry three different mission modules (MMs)—countermine warfare, surface warfare (especially countering small "swarmed" patrol boats), and anti-submarine warfare. Subsequently, survivability issues have led to a requirement to equip the ships with more self-protection capabilities.

**Date of program initiation**: Concept studies were initiated in 2002, with preliminary design contracts awarded in July 2003. The schedule was highly compressed (the Chief of Naval Operations (CNO) reportedly directed the program to "get the hulls in the water with the speed of heat"). In addition, the CNO directed that the ships cost no more than $220 million each (FY 2005 dollars). Milestone A was approved in May 2004 and contracts were awarded to Lockheed Martin and General Dynamics, with each using different designs.

**Date of first statement of requirement**: Initial Capabilities Document, January 2004. The requirement was driven by capability gaps when operating against littoral access-denial threats. In particular, gaps existed against mines; small, fast, highly armed boats operating in groups; and quiet diesel submarines operating in shallow water.[104]

**IOC**. LCS—April 2014; LCS-Mission Modules—November 2014 (surface warfare)

**Scale of acquisition**: The December 2015 SAR reflects a total program cost of $28.9 billion for 40 ships. This is for the ships only, not the mission modules, which are reported at $7.6 billion in a separate SAR.

**Maturity of technologies**: While ship construction technology was mature, difficulties arose in adapting commercial designs and construction practices for a military ship. Initial Navy assumptions regarding that issue turned out to be naïve, and the consequences are still being dealt with.

---

[103] Ibid, 30.

[104] Acquisition Strategy document, December 2007.

Complexities arose when requirements were imposed to provide “level 1” protection specified by the Naval Vessel Rules. (It had been assumed early in the program, when the $220 million cost goal was established, that the ships would not have to meet those criteria—this disconnect reflects the fundamental lack of consensus on requirements cited above.) Meeting the Level 1 criteria caused significant cost growth and schedule slippage. Subsequently, higher levels of protection have been imposed for follow-on ships, based on a need to operate in higher threat areas.

**Degree of urgency**: What drove the sense of urgency for the program is not clear. The Navy has recently retired all its frigates, under the assumption that LCS would perform that role. Now, as limitations of the LCS designs become more apparent, the Navy is considering LCS upgraded designs (“LCS+”) that would be better able to fulfill the frigate role in the fleet.

**Degree of consensus**: Controversial both within and outside Navy. Initially there was no consensus on requirements regarding such basic factors as speed, survivability and payload.

**Acquisition approach**:[105] The acquisition approach was unorthodox and the schedule highly compressed. Much of the program management responsibility was turned over to the contractors—the government program office was significantly understaffed, especially in experienced personnel. The lead ships received contract approval at Milestone A. The LCS is being procured in two MDAPs—“LCS” for the ships themselves (“Seaframes”) and “LCS-MM” for the interchangeable mission modules. A CAIV approach was taken, and requirements were relaxed in attempts to control cost overruns. For example, the transit range threshold of 3,500 nm at 18 kts was reduced to 2,650 nm at 18 kts.

The program began as a winner-take-all design competition; however, ultimately, the Navy decided to procure both designs in equal numbers. The most recent SAR and Defense Acquisition Executive Summary reports reflect a procurement objective of 50 ships (plus the two built with RDT&E funds). Reflecting concerns about LCS capabilities and survivability, in February 2014, the Secretary of Defense announced that only 32 ships would be produced and directed the Navy to conduct a study to define alternatives for the remaining 20-ship requirement.[106] In December 2014, the Navy reported that enhanced LCS designs were the

---

[105] See Porter, *et al*., IDA Paper P-4531, for a succinct yet reasonably complete recount of the LCS acquisition program.

[106] The Secretary asked Navy to “submit alternative proposals to procure a capable and lethal small surface combatant, consistent with the capabilities of a frigate, I am concerned that the Navy is relying too heavily on the LCS to achieve its long-term goals for ship numbers. Therefore, no new contract negotiations beyond 32 ships will go forward. With this decision, the LCS line will continue beyond our five-year budget plan with no interruptions.”

best alternative, a choice that was accepted by the secretary. The upgraded designs are to be phased in with the FY 2019 buy.

There has been a large amount of concurrency in the program, which is still going on. The GOA has criticized the Navy for proceeding with production before IOT&E events are held. The Navy wishes to avoid production line breaks, and delays in mission equipment availability have caused delays in operational testing.

Efforts to accelerate this acquisition were not successful. The initial 2004 SAR for LCS reflected a projected IOC of October 2007 with Milestone C in December 2010. The most recent SAR reports that Milestone C occurred in January 2012, with IOC in April 2014. (The reason for the reversal in the order of these dates is not known—perhaps the definition of IOC changed.). It is too early to judge the success of the program overall. At least, ships are being delivered and operating, so it obviously has achieved some level of success.

#### Lessons Learned

Like FCS, this program was driven initially by an initiative of the service chief, who specified highly aggressive schedule and cost constraints that proved to be unrealistic. The lack of an initial consensus on basic requirements subsequently translated into costs at least double initial estimates and years of schedule slippage. In other words a classic case of haste makes waste, based on a sense of urgency that was questionable to begin with.

### M. Joint Air-to-Surface Standoff Missile (JASSM)

**Purpose**: An air-launched stealthy cruise missile capable of attacking high-value targets at sufficient standoff range to limit exposure to air defenses.

**System description**: A 2,250-lb subsonic (0.80 mach), air-to-surface, cruise missile with long range, standoff precision strike, and adverse weather and low observable capabilities. Its mission is to defeat high value and highly defended fixed and relocatable targets (e.g., air defense, command and control, and mobile missile launchers). It is conventionally armed with a 1,000-pound penetrating warhead intended for use against soft, medium, and hard targets. Its navigation capabilities include an anti-jam, GPS inertial navigation system and a terminal infrared (IR) seeker.

**Date of program initiation**: September 1995

**Date of first statement of requirement**: Operational Requirements Document dated January 20, 2004

**IOC**: December 2004 (Required Assets Available (RAA) for F-16 aircraft)

**Scale of acquisition**: The December 2015 SAR reflects a total program cost of $7.3 billion for both the basic and extended range JASSMs (4987 missiles, 1900 of which had been delivered)

**Degree of urgency**: Previous efforts to develop such a capability had failed. Emerging "near peer" threats in Asia and Europe and surface-to-air missile (SAM) threats of growing sophistication in the Middle East and Southwest Asia provided a sense of urgency, if not immediate operational needs.

**Degree of consensus**: Relatively high. Originally, JASSM was a joint program with the Navy, but the Navy dropped out in 2006 (after repeated test failures and cost increases).

**Maturity of technologies**: Stealth technology was relatively mature by 1995. The challenge was in producing a low-cost missile.

**Acquisition approach and outcomes**: JASSM was a standard MDAP but the program was based on highly ambitious cost and time parameters, and thus required use of novel approaches (see below). A "poster child" of the mid-1990s acquisition reform movement—CAIV, "Total System Performance Responsibility," and "Civil-Military Integration." The program had especially ambitious goals: to develop and field a missile at half the cost and in half the time ($400K unit procurement cost and IOC in 60 months) of similar programs of the past.

Ultimately, the program has succeeded in deploying missiles with acceptable reliability and effectiveness at a unit cost very close to *early* cost estimates before the "acquisition reform" notions were applied and unrealistic cost and schedule objectives established for the program. The original procurement objective of more than 4,000 missiles was reduced to 2,100 (1,683 delivered to date) in favor of an extended range (ER) version, which is currently in LRIP. The procurement of the baseline missile, which has never reached the originally projected production rates, is expected to be complete in FY2016 at an average unit procurement cost of $880,000 in FY2010 dollars. (The original production goal was to produce 3,700 missiles by FY2014 at an average unit procurement cost of $439,000 in FY1995 dollars.) The procurement objective for the ER version is 2,897 missiles, projected to be completed in FY2023, at an average unit procurement cost of $1,192,000 FY2010 dollars.

A relatively accelerated 40-month EMD program was defined. Program management was largely relegated to the prime contractor (Lockheed Martin). The ambitious cost objective was to be achieved through use of commercial business practices and processes, including dual-use and COTS components, technology, and manufacturing capabilities, non-traditional suppliers, and small businesses. Numerous adaptations of various commercial technologies and manufacturing processes from diverse commercial sectors were employed. Examples include structural materials from the leisure marine industry, tooling from sporting goods, automation equipment for consumer textiles, and digital processors from the automotive industry.

LRIP was originally scheduled to begin 24 months after award of the EMD contract, with a Milestone II (Full rate production decision) 19 months later.

Schedule was secondary to cost in the development strategy; however, the failures resulting from efforts to achieve cost objectives had a substantial impact on schedule. The original RAA for deployment on the F-16 was December 2001; the actual was December 2004—a three-year delay.

Initial operational tests revealed serious reliability issues. Examples of major reliability failures include engine no-start, wing deployment failure, GPS signal dropout, fuse failure to arm, and warhead failure to detonate.

Reliability issues originated from an innovative approach to performance specifications, which did not include explicit reliability objectives; rather, the performance specification was based on the outcomes of simulations that would show if the missile was capable of achieving a specified level of target kill—17 kills with 55 missiles. Thus, reliability failures could be compensated for by high values in in-flight survivability and lethality. This method of assessing effectiveness proved unacceptable to the operational community. So a missile reliability performance specification was introduced, but the missile was unable to meet this specification without significant redesign and changes to suppliers.

**Lessons Learned**

This program (among many others) illustrates the adverse consequences of initial cost goals that were based on unrealistic assumptions. That mistake was compounded by a management approach that gave too much control to the prime contractor with inadequate and incompetent government oversight. Lastly, a novel approach to specifying requirements backfired when operational tests revealed low missile reliability that was unacceptable to operational community.

## N. Summary Findings and Lessons Learned

### 1. Findings

From these cases, the following overall findings were derived:

- Almost all successful accelerated acquisitions employ either current or recently developed technologies (An exception is the rare crash technology development program, specifically the F-117A. However, there the strategy was to specifically limit the technology development to that needed for implementing the stealth capabilities and assiduously minimize any other tech development—using mostly off-the-shelf technologies.)
  - Rapid acquisition of existing capabilities to address unrecognized or unaddressed wartime needs that do not push state of art

- Several were experimentations with previously developed but under-exploited technologies (i.e., innovative capabilities for which a formal military requirement did not exist) (Specifically the HALE UAVs)

- Programs offer insights on impacts and implications of accelerating acquisitions—both positive and negative
- Shortening acquisition times by skipping or rushing certain planning steps, management reviews or development and testing regimens introduced risks that these acquisition steps were design to avoid (such as sustainment, disposal, addressing real needs), including:
  - Truncated testing program
  - Sustainment issues
  - Transition problems
  - Wasted/unneeded—unused systems, disposal issues
- Many programs got innovative capabilities into the field that would not have gotten there without special measures
- Sometimes accelerating acquisition to provide a limited capability in the near term can lead to spiral acquisition to provide enhanced capabilities later. There may be inefficiencies in that process, so the benefits must be carefully weighed against such costs.

## 2. Lessons from Cases

There are some useful lessons to consider when taking on "accelerated acquisition"

- Mechanisms clearly exist and have been used successfully for accelerated acquisition—usually driven by high-level priorities or external urgencies.
- Programs that accelerated the development, experimental fielding, and acquisition of new technological capabilities were based on novel processes, such as the ACTDs, which have largely dissipated. Should similar processes be instituted today?
- Programs need to balance "risks of commission" (skipping steps or rushing, which risks failure to meet user needs) against "risks of omission" (the opportunity cost of not providing the warfighter with at least some capability sooner versus waiting for a more capable system later)
- Investments in technology maturation and system prototyping/experimentation facilitated innovation

- In a world where an increasing portion of system capabilities are based on data and software, development approaches such as evolutionary, spiral, and agile offer an attractive way to advance innovation in many areas without introducing program risks.

# 3. Conclusions

Accelerating acquisition programs introduces certain risks (as explained below) while mitigating others (particularly being unresponsive to existing or emerging near-term requirements or opportunities). DOD policy has emphasized using only mature technologies to keep acquisition programs on time and within budget,[107] but in some circumstances DOD benefits from introducing developmental but operational capabilities into the field for early warfighter experimentation and use.

## A. Managing Tradeoffs

**Fundamentally, in deciding on accelerating an acquisition program, there is a need to balance "risks of commission" with "risks of omission**." Risks of commission, such as skipping standard acquisition steps, eliminating management assessments, or ambitious schedules, can result in performance shortfalls or downstream problems, such as suitability, reliability, supportability, higher long-term costs (due to multiple fielded models) and future operational value. Risks of omission are the opportunity cost of not providing operational forces with some useful level of capability in the near term versus providing a fully capable system some time later. These costs can often be measured in lives or operational success. Although thousands of MRAPs are being scrapped or sold off today, they saved many lives by being delivered sooner rather than later.

DOD's Better Buying Power 3.0 provides for tailored acquisition aimed at making trade-offs in performance and cost to get capabilities more rapidly into the field. However, this raises an acquisition strategy issue: When does it make sense to accelerate an acquisition in order to provide an interim solution in the near term and then additional capabilities later, if still needed? **Acquisition programs should be accelerated when the value of having the operational capability sooner is compelling, weighed against the risks of skipping or rushing the standard acquisition system**.[108]

**This tradeoff requires an assessment that balances current and projected requirements with the existing and expected technologies available to meet them.** The essential question is, "what needs have to be addressed at what time?" For urgent operational

[107] See Jacques S. Gansler and William Lucyshyn, *Cost as a Military Requirement*, Center of Public Policy and Private Enterprise, University of Maryland, January 2013, for a perspective on affordability constrained acquisition.

[108] The current DODI 5000.02, specifically calls for "the understanding of the technical, cost, and schedule risks of acquiring the materiel solution, and the adequacy of the plans and programmed funding to mitigate those risks." 18.

needs, the requirements are clear. The problem is that, in important cases, those needs have not been acted on. For important but less urgent needs, requirements timing is key—what needs to be provided by when? In both cases, if a capability is desired sooner than the forecasted availability of required technologies, then either technology development will need to be accelerated or the program will need to accept an incomplete solution in the near term—and perhaps both.

To achieve these tradeoffs it is necessary for the requirements, technology development, and acquisition communities to work together closely with end users to define programs based on technologies that can be matured and implemented in the required timeframe within an acceptable level of risk. Clearly, considerable front-end thinking and planning are required to achieve capabilities more quickly while avoiding potentially disastrous consequences. In the successful accelerated acquisition programs examined in this study, there were explicit tradeoffs made to achieve something "initial," "good enough," and "sufficient," to address a threat or need, recognizing that over the long term there would be problems or deficiencies that would have to be addressed.

There is thus the need for competent and experienced acquisition personnel trained in such approaches and resourced to implement them. Some "accelerated acquisitions" in the 1990s-2000s failed partly because poor assumptions were made regarding the staffing capabilities needed, in an environment where DOD managers were under pressure to reduce personnel and streamline oversight. Management experiments in turning oversight responsibilities over to contractors also proved deleterious.

A common theme in the programs considered in this research is that innovative capabilities were introduced by and supported by mechanisms largely outside of the "normal" development and acquisition processes. Furthermore, they were outside the existing institutional priorities of the individual services. Most of the case studies were driven by the imperatives and directions of OSD, DARPA, and Combatant Commanders, usually to meet emerging operational needs.[109] Funding has been an issue with conducting such programs during peacetime.

---

[109] These *needs* are not the same as military *requirements* defined through the Joint Chiefs of Staff Requirements Process. They are either needs identified through various experimentation, war gaming, or assessment processes or are identified post hoc through urgent needs (JUONS) or similar means from the combat commands. In the former case, these needs could not be defined as requirements because the capabilities were not known to those setting the requirements. In the latter case, these needs were [*continued*] not stated as requirements because they were not recognized as being of sufficient importance under the then prevalent threat assessments to drive system developments and thus became gaps when they became evident in subsequent conflict.

## B. Rapid Acquisition

No matter how well we can anticipate, there likely will be adversary capabilities for which we did not have a pre-developed response. Our assessment reviewed programs using mechanisms for quick reaction or rapid response that have successfully met urgent needs. But, with the winding down of U.S. engagements in Iraq and Afghanistan, these mechanisms have withered, as has funding for them. This raises the issue of whether or not the means and funds for such rapid response should be continued. We contend that, given the uncertainties of the DOD requirements process in anticipating future requirements, rapid acquisition mechanisms need to be preserved. In our case studies, the primary causes for delay were a lack of responsiveness in the headquarters-level requirements processes, and problems with their interfaces with the acquisition and budgeting processes.

Moreover, because they are aimed at meeting immediate needs, they must focus on low-risk, currently available technologies. Therefore, systematic efforts are needed to seek out available commercial and military technologies from around the world ("technology scouting") to increase the portfolio of technologies available for rapid insertion into defense systems. In the past DOD experimented with processes to engage the operational forces in identifying potential gaps and searching for technical capabilities that could be acquired as-is or easily modified to fill them.[110] We believe that such processes should not be just after-the-fact, *ad hoc* mechanisms instituted during times of conflict. Rather, they should be ongoing collaborations between the operational commands and the technology development community—similar to the open innovation practices of leading commercial firms.[111]

By definition, rapid acquisitions cannot be funded through the standard PPBES[112] processes, since, as an *absolute minimum*, 18 months elapse between the time money is requested by an acquisition activity to be included in the President's Budget to the time that the funds are available for obligation on a contract. In the recent past, OCO supplemental appropriations have provided funds more quickly and flexibly. And the reprogramming processes to move already-appropriated funds (either OCO or base budget) to meet more urgent needs have been exercised effectively.

---

[110] Prior programs in the 1990s included the Dual Use Application Program and the Commercial Technology Insertion Program, which aimed to link Combatant Command input on needs to search processes for available or emerging technical capabilities.

[111] Richard Van Atta, Michael Lippitz et al., *Commercial Industry Research & Development Management Best Practices*, Alexandria, VA: Institute for Defense Analyses, Paper P-4814, December 2011.

[112] Planning, Programming and Budgeting and Execution System.

Many have recommended establishment of set-aside funds to be used for emerging urgent needs,[113] and several attempts have been made along those lines. In the mid-2000s, the OSD JRAC office requested funds for a rapid acquisition account, but the requests never received Congressional approval.[114] As discussed in Appendix A, the Joint Improvised Explosive Device Defeat Organization (JIEDDO) was funded in a 3-year appropriation with "colorless" money, meaning it could be spent within any budget title, and more time was allowed before funds expired. And DOD made use of that flexibility by assigning rapid acquisitions to JIEDDO for items only tangentially related to IEDs. Having such a funding source on a long-term, continuing basis, while advantageous in theory, also has drawbacks making it difficult to implement and sustain—primarily the real risks that such funds will not be used as intended.

The acquisition process has proved capable of responding rapidly to urgent operational needs by exploiting existing systems and technologies. However, those successes needed strong leadership support to overcome bureaucratic obstacles, as well as immediately available funding. However, with the winding down of U.S. engagements in Iraq and Afghanistan, support for the enabling mechanisms may be on the decline. If allowed to wither entirely, it will be more difficult to reinstate such processes when needed in the future.

Crash development of an advanced new capability for high-priority current or emerging problems requires top-level focused management and oversight. Those opportunities will likely be rare, but could be very important.

## C. Technology Maturation

**A key conclusion is that investments in maturation of emerging technology are needed to allow programs to be delivered both more rapidly and with greater innovation**. Because accelerated acquisition typically must focus on existing and "nearly-available" technologies, the more of these technologies that are "in the quiver," the greater the horizons of application.[115] For instance, the Air and Missile Defense Radar (AMDR) and

---

[113] For example: Defense Science Board, *Fulfillment of Urgent Operational Needs*, OUSD (AT&L), July 2009, 32.

[114] The Congressional appropriation committees' position is that the existing reprogramming authorities are adequate to provide such emergency funding, and they will willingly expedite the approval process for above-threshold reprogramming requests when such action can be justified. Of course, reprogramming requires identification of funds already allocated to other programs, which can result in disruptions and inefficiencies in those program. Within reasonable bounds, though, funds not immediately needed can normally be found for a truly urgent need.

[115] Allocation and management of S&T investments is beyond the scope of this task, though our previous research recommended several processes for identifying and tracking emerging technologies and improving linkages between technology maturation priorities and acquisition programs. See Richard Van Atta, Michael Lippitz, et al., *Commercial Industry Research and Development*.

the Next Generation Jammer (NGJ) programs were able to leverage advanced gallium nitride technologies that had been previously matured, making these systems responsive to the emerging threat.[116] Others, such as the Common Infrared Countermeasures and the Integrated Force Protection Capability (IFPC) programs, did not have such advanced technical options available.[117] Moreover, some unsuccessful efforts to accelerate acquisition were thwarted by immature or unavailable technologies, most notably FCS.

Technology maturation problems often cut across multiple acquisition programs, with the "early adopters" bearing the costs of learning how to make the technology operational and effective. There will also typically be competing contractors involved. Inevitably, this will lead to different visions as to which characteristics of the technologies in question should be emphasized first in development. Additional work is needed to clarify the linkages, processes, approaches, and practices that best promote appropriate understanding of technology maturation as it relates to acquisition decisions, especially setting realistic schedules and managing to them.[118]

## D. Prototyping, Experimentation and Agility

**The ability to quickly prototype and then experiment with novel systems in the field—bypassing the standard requirements processes—is another foundation of innovative accelerated acquisition**. Past DOD activities for accelerating experimental implementation of innovative concepts, specifically ACTDs, had some notable success in fielding new technologies that then transitioned into acquisition programs, particularly the

---

[116] It would be instructive to document how the GaN technology maturation was linked to these program successes. Also, how are current programs, such as Future Vertical Lift, trying to address technology maturation early on? What was the understanding at the outset of these programs of the technology's maturity and the risks involved? For instance, what was the relationship between those responsible for developing and maturing GaN-based technologies, including the subsystems employing it, and those responsible for defining these programs (Program Office and contractors)? What was considered regarding this in the Milestone decisions and in defining the Technology Maturation and Risk Reduction program? How did this compare to similar technology development efforts such as the introduction of gallium arsenide (GaAs) a decade before? How rigorous and systematic is the consideration of technology maturation and means for affecting it in arriving at MDAP decisions, particularly regarding time and risk assumptions? When such considerations of technology maturity and risk are made how are these related to requirements and when the systems capabilities are needed?

[117] Richard Van Atta, et al., *Assessing Weapon System Acquisition Cycle Times: Setting Program Schedules,* Institute for Defense Analyses, IDA Document D-5530, June 2015.

[118] Questions raised include: What is understood, what is assumed based on what others are doing to mature technologies regarding decisions to establish an acquisition program? What are the risk profiles for these, based on what kinds of information? Who is responsible for making these assessments, and who is responsible for developing the technologies? What is industry's role in all this? How do these get reflected in setting the acquisition schedule? What is the role of systems engineering, and does the DOD have sufficient systems engineering expertise?

Predator and Global Hawk UAVs. As evidenced by the complete absence of even a mention of experimentation in the current DODI 5000.02, such approaches have largely withered; however, two more recent developments provide some prospect of revitalization. In November 2014, Secretary Hagel announced "The Defense Innovation Initiative,"[119] and the 2016 NDAA contains provisions specifically aimed at enhancing DOD prototyping and experimentation.[120] Review of those initiatives is beyond scope of this research.

An additional advantage of increased prototyping and experimentation is the ability to adjust requirements to reflect changing circumstances and lessons learned. Projected requirements can be difficult to state accurately, especially several years into the future. Circumstances may change during development. **Approaches that emphasize delivering initial or interim capabilities to users sooner—with their participation and agreement—can address immediate needs while lessening the risks of expending vast sums on systems that may not be needed in the future**. Specifically, such experimentation for innovation should be linked to iterative, spiral development and evolutionary acquisition approaches. The current DODD 5000.02, does not include any of those terms; however, it does stress modular designs and open systems architectures as "valuable mechanisms for continuing competition and incremental upgrades…"[121] The reasons for those changes have not been determined in our research.

In the face of rapid evolution in technology and concomitant market changes, many companies today are embracing lean, iterative approaches—including industrial, engineering-oriented firms like General Electric (GE). GE found that, like DOD, much of the time required to develop, for example, a new jet engine was due to internal bureaucracy. Moreover, many internal controls were not focused on making sure that user needs were being met. (Even those emphasizing six sigma practices at GE eventually got on board, recognizing that early failures did not reflect poor engineering discipline but rather learning that reduced variability in the long run.)[122]

---

[119] Memorandum, Secretary of Defense Chuck Hagel, November 15, 2014, Subject: The Defense Innovation Initiative.

[120] The NDAA 2016 SEC. 218. DEPARTMENT OF DEFENSE TECHNOLOGY OFFSET PROGRAM TO BUILD AND MAINTAIN THE MILITARY TECHNOLOGICAL SUPERIORITY OF THE UNITED STATES focuses on establishing "a technological offset program" for accelerating fielding of "offset technologies" including "developing and implementing new policies and acquisition and business practices" for these. SEC. 804. MIDDLE TIER OF ACQUISITION FOR RAPID PROTOTYPING AND RAPID FIELDING focuses on the need to quickly develop and experiment with innovative new prototype defense capabilities.

[121] Defense Instruction 5000.2, "Operation of the Defense Acquisition System," 2015, 86

[122] Jørn Bang-Andersen and Michael J. Lippitz, "Where the Rubber Meets the Road: Scaling New Ventures at Large, Established Companies," *InnovationManagement.se*, in press.

Today's defense systems are characterized by an increasing portion of their capabilities based in software. Since software is typically built in modules of capability and can be designed to be modified relatively quickly to meet changing needs, this trend offers attractive ways to advance the pace of innovation in many areas while potentially reducing risks.

## E. Summary

**Shortening weapon system acquisition cycle times requires much more than simply accelerating the current processes.** It requires focused technology development and maturation, progressing to subsystems and systems prototyping and experimentation that can transition to well-managed acquisition programs. A common theme in the programs considered in this research is that most of these innovative capabilities did not follow all the steps and procedures that characterize the normal development processes–and usually required intervention and support from top DOD management.

# 4. Recommendations

This research reviewed several cases of accelerated acquisition to glean lessons applicable to future efforts. From them we have derived recommendations for applying such practices or approaches to future defense systems development and acquisition.

Our first recommendation is that for most defense acquisition programs, **speed *per se* should not be the objective—rather it should be responsive, effective, efficient, innovative acquisition of defense capabilities that meet clearly defined operational needs**. Looking to the future, the objective should be to develop technological opportunities for new defense capabilities to address future threats in a responsive, timely, and affordable manner. From this objective:

1. Decisions to accelerate an acquisition should be based on assessments that show:
   - Technical maturity relative to achieving operational value
   - Clear assessment of the costs and risks of acceleration and mitigation measures to address these risks
   - Needs or requirements defined relative to what can be achieved within specific timeframes.
2. The approach for accelerated acquisition should be matched to a clear understanding of the problem to be addressed. Three specific approaches to accelerated acquisition require different management approaches:
   - Meeting an existing need now requires rapid acquisition capabilities
   - Injecting new technical capabilities into the operational environment to assess their value requires experimentation and evaluation with expectation for subsequent spiral or evolutionary acquisition, or
   - Crash development of an advanced new capability for high priority current or emerging problem requires high-level focused management and oversight.
3. Timely innovation to meet future but uncertain needs requires a coordinated program of technology development linked to prototyping and operational experimentation and use that can iteratively transition to implementation. Processes for doing this should be revitalized and funded to include:
   - Explicit, systematic, structured, and well-funded processes for targeted, focused technology development and maturation, best managed by the

Assistant Secretary of Defense for Research and Engineering in coordination with service equivalents, on a few carefully selected "future bets" to support potential new future concepts;[123]

- Explicit, funded mechanisms to develop and integrate such concepts as operational prototypes and conduct experiments with them in operational environments directly with the operational community;
- Defined processes and organizational structure for transitioning and incrementally improving such capabilities based on user feedback as pre-MDAP systems using flexible acquisition approaches;
- Tailored iterative, evolutionary processes to acquire the systems, if scale-up is indicated by the current and projected operational environment and buttressed by positive user feedback.

The responsible organizations throughout DOD charged with assessing operational environments and identifying gaps that can be closed by current or evolving technologies should be strengthened. Programs with those objectives should be adequately funded and sustained to continually foster and support rapid development, acquisition, and fielding of state-of-the-art capabilities in the force.

[123] See David Graham, et al., *Strengthening DOD Laboratories: A Proposal for a Virtual Central Laboratory to Support Enterprise-Level Innovation*, IDA Paper P-4976, Alexandria, VA: Institute for Defense Analyses, 2013.

# Appendix A.
# Background and DOD Policy Related to Rapid and Accelerated Acquisition

Over many years, acquisition practitioners and their customers and critics have complained about the length of time it takes for DOD to field new weapon systems. Some outliers that took up to 20 years from program initiation to fielding were particularly troubling. While some have complained that the situation has been getting worse, we noted in our previous work that in fact there has actually been a small improvement in meeting program schedules, at least by some measures.[124] However, soon after the initiation of combat operations in Iraq in 2003, it became apparent that U.S. forces, which had been built primarily for conventional warfare, were ill-prepared for the kind of irregular warfare that ensued in Iraq after the initial take-down of the Saddam regime. Thus, there was a need to equip DOD forces with systems better suited for the type of operations being undertaken, and to do so as soon as possible. This necessity gave rise to an intensive effort to identify and quickly acquire the appropriate equipment—i.e. a rapid acquisition process.

In fact, each of the military services established such a process, as did the Joint Staff and OSD. A working group was established chaired by the Deputy Secretary of Defense. There was a great deal of Congressional interest as well, and numerous provisions were written into laws. A Joint Improvised Explosive Device Defeat Organization (JIEDDO)[125] was established and liberally funded ($4 billion at its peak, with a staff of over 3,000) and Congress provided great flexibility for JIEDDO on how their appropriated funds can be used.[126] Both Joint Staff and OSD issued instructions and directives.[127]

Military service efforts include the Army's Warfighter Rapid Acquisition Program (WRAP) and Rapid Equipping Force, the Air Force's Big Safari, dating back to 1952, which was involved in several of the cases of accelerated acquisition reviewed here. Navy and

[124] See IDA Document D-5330, 4.

[125] In November 2015, the name was changed to the Joint Improvised-Threat Defeat Agency (JIDA).

[126] For example, JIEDDO was funded in a 3-year appropriation with "colorless" money, meaning it could be spent within any budget title and more time was allowed before funds expired. And DOD made use of that flexibility by assigning for rapid acquisitions to JIEDDO for items only tangentially related to IEDs.

[127] Chairman of the Joint Staff Instruction (CJCSI) 3470.01, *RAPID VALIDATION AND RESOURCING OF JOINT URGENT OPERATIONAL NEEDS (JUONS) IN THE YEAR OF EXECUTION*, July 2005,, and DODD 5000.71, *Rapid Fulfillment of Combatant Commander Urgent Operational Needs*, August 2014. Subsequently CJCSI 3470.01 was rescinded and the provisions incorporated into CJCSI 3170.01H, *Joint Capabilities Integration and Development System*, January 2012.

Marine Corps have similar processes. These rapid acquisition programs typically use or modify existing technologies and highly responsive and flexible acquisition approaches.

The January 2015 DODI 5000.02 devotes Enclosure 13 to "Rapid Fielding of Capabilities" to specify "policy and procedure for acquisition programs that provide capabilities to fulfill urgent operational needs and other quick reaction capabilities that can be fielded in less than 2 years and are below the cost thresholds of Acquisition Category (ACAT) I and ACAT IA programs" and further states:

> DoD's highest priority is to provide warfighters involved in conflict or preparing for imminent contingency operations with the capabilities urgently needed to overcome unforeseen threats, achieve mission success, and reduce risk of casualties, as described in DoD Directive 5000.71 (Reference (cc)). The objective is to deliver capability quickly, within days or months. DoD Components will use all available authorities to expeditiously fund, develop, assess, produce, deploy, and sustain these capabilities for the duration of the urgent need, as determined by the requesting DoD Component. Approval authorities for each acquisition program covered by this enclosure will be delegated to a level that promotes rapid action. (p. 143)

In addition providing for *rapid acquisition* in response to urgent operational needs, the January 2015 DODI 5000.02 recognizes the need for *accelerated* acquisition, the fourth of four "acquisition models" that are described.[128]

Thus it is seen that the extant DOD acquisition system clearly recognizes the need for flexibility in the acquisition process to achieve more rapid fieldling of new capabilities. It does not appear, however, that those flexibilities are actually being employed by very many acquisition programs. Possibly that is because of the relatively recent incorporation of the provisions in DODI 5000.02; but a more likely explanation is that acquisition managers are risk averse, and have few incentives to accelerate programs unless there is a widely recognized need to guarantee that such initiatives would find higher level support.

---

[128] DODI 5000.02, January 2015, 13.

# Appendix B.
# Illustrations

## Figures



## Tables

# Appendix C.
# References


*Army Strong: Equipped, Trained and Ready, Final Report of the 2010 Army Acquisition Review*. Department of the Army. January 2011.

David Aronstein and Albert Piccirillo. "Have Blue and the F-117A: Evolution of the Stealth Fighter." Reston, VA: American Institute of Aeronautics and Astronautics. 1997.

Seth T. Blakeman, Anthony R. Gibbs, and Jeyanthan Jeyasingam. "Study of the Mine Resistant Ambush Protected (MRAP) Vehicle Program as a Model for Rapid Defense Acquisitions, Monterey, Calif.: Naval Postgraduate School, 2008.

Jørn Bang-Andersen and Michael J. Lippitz. "Where the Rubber Meets the Road: Scaling New Ventures at Large, Established Companies." InnovationManagement.se, in press.

Barry Boehm. "A Spiral Model of Software Development and Enhancement." *Computer*, May 1988, pp. 61-72.

Nir N. Brueller, David R. King, and MAJ. Rojan Robotham. "The Limits of Competition in Defense Acquisition." DAU Research Symposium, September 2012.

Michael Bulkey and Gregory Davis. "The Study of Rapid Acquisition Mine Resistant Ambush Protected (MRAP) Vehicle and Its Impact on the Warfighter." Monterey, CA: Naval Postgraduate School, June 2013.

Ashton Carter. "Running the Pentagon Right." *Foreign Affairs*, January/February 2014, pp. 101-112.

Ashton B. Carter and J. Michael Gilmore. "Running the Numbers on MRAPs: Reliable Data Proves the Vehicles are Worth the Money." *Foreign Affairs*. October 2012.

Chairman of the Joint Staff Instruction CJCSI 3470.01, *Rapid Valication and Resourcing of Joing Urgent Operational Needs (JUONS) in the Year of Execution.* July 2005. and DODD 5000.71, *Rapid Fulfillment of Combatant Commander Urgent Operational Needs,* August 2014.

Chairman of the Joint Staff Instruction CJCSI 3170.01H. *Joint Capabilities Integration and Development System*. January 2012.

Department of Defense Directive (DODD) 5000.01. *The Defense Acquisition System.* November 2007.

Department of Defense Instruction (DODI) 5000.02. *Operation of the Defense Acquisition System*. January 2015.

Defense Science Board. *Fulfillment of Urgent Operational Needs.* OUSD(AT&L), July 2009.

Jeffrey Drezner, et al., *Innovative Management in the DARPA HAE UAV Program*, MR-1054-DARPA, Santa Monica, CA: RAND Corporation, 1999.

Jeffrey Drezner and Robert Leonard. "Global Hawk and Dark Star: Transitions Within and Out of the HAE UAV ACTD Program." Santa Monica, CA: RAND Corporation, 2002.

Peter Eisler, Blake Morrison, Tom Vanen Brook. “Pentagon Balked at Pleas from Officers in Field for Safer Vehicles.” *USA Today*. July 7, 2007.

Thomas Erhard. "Unmanned Aerial Vehicles in the United States Armed Services: A Comparative Study of Weapons System Innovation." PhD Dissertation. Baltimore, MD: Johns Hopkins University, 2001.

Thomas Erhard. *Air Force UAVs: The Secret History*. Mitchell Institute Press. Air Force Association, 2010.

Joe Ferrara. “DOD’s 5000 Documents: Evolution and Change in Defense Acquisition Policy.” A*cquisition Review Quarterly*. Fall 1996, pp. 109-130.

Jacques S. Gansler and William Lucyshyn. "Cost as a Military Requirement." Center of Public Policy and Private Enterprise. University of Maryland, January 2013.

Jacques S. Gansler and William Lucyshyn. “Using Spiral Development to Reduce Acquisition Cycle Times." Center of Public Policy and Private Enterprise. University of Maryland. May 14, 2008.

Robert M. Gates. *Duty,* Alfred Knopf, 2014.

Dan Gettinger. “Drone Spending: the MQ-9 Reaper.” Center for the Study of the Drone. Bard College. October 12, 2015. http://dronecenter.bard.edu/.

David Graham, et al. *Strengthening DOD Laboratories: A Proposal for a Virtual Central Laboratory to Support Enterprise-Level Innovation*. IDA Paper P-4976, Alexandria, VA: Institute for Defense Analyses, March 2013.

Harry Greene, Larry Stotts, Ryan Paterson, Janet Greenberg. “Command Post of the Future: Successful Transition of a Science and Technology Initiative to a Program of Record.” *Defense Acquisition Review Journal*. January 2010, pp.3-23.

Chuck Hagel. Memorandum, Office of the Secretary of Defense. Subject: The Defense Innovation Initiative. November 15, 2014.

Caitlin Harrington. “USAF Confirms Project Liberty Plans to Deploy ISR Aircraft.” *Janes Defense Weekly*. Jan. 27, 2009.

Wade Henning and Daniel Walter. "Spiral Development in Action: A Case Study of Spiral Development in the Global Hawk Unmanned Aerial Vehicle Program." MBA Professional Report. Monterey, CA: Naval Postgraduate School, December 2005.

Michael C. Howitz. "The Mine Resistant Ambush Protected Vehicle: A Case Study," Carlisle Barracks, Pa.: U.S. Army War College, March 2008.

Richard Hundley. *Past Revolutions, Future Transformations.* Santa Monica, CA: RAND Corporation, 1999.

Frank Kendall. "Better Buying Power 3.0." White Paper, Office of the Under Secretary of Defense (Acquisition, Technology and Logistics). September 19, 2014.

Frank Kendall. Implementation Directive for Better Buying Power 3.0 – Achieving Dominant Capabilities through Technical Excellence and Innovation. U.S. Department of Defense, Office of Under Secretary of Defense (Acquisition, Technology and Logistics). April 3, 2015.

William Knox. "Of Gladiators and Spectators: Aquila, a Case for Army Acquisition Reform." Carlyle, PA: U.S. Army War College. 1994.

Andrew Krepinevich and Evan Montgomery, "Correcting Course: The Cancellation of the Future Combat Systems Program," Washington, D.C.: Center for Strategic and Budgetary Assessments, July 2009.

Christopher J., Lamb, et al. "MRAPs, Irregular Warfare, and Pentagon Reform." Washington, D.C.: National Defense University. June 2009.

Christopher J. Lamb and Sally Scudder. “Why MRAP is Worth the Money: Dispelling the Flawed Logic of One Battlefield Study.” *Foreign Affairs*. August 2012.

Col William S. Leister. “MQ-9 Reaper Unmanned Aircraft System.” Compendium of Annual Program Manager Assessments for 2015. Office of the Under Secretary of Defense, Acquisition, Technology, and Logistics. September 23, 2015.

Mark Lorell, Julia Lowell, Obaid Younossi. “Evolutionary Acquisition: Implementation Challenges for Defense Space Program.” Santa Monica, CA: RAND Corporation, 2006.

Frances Lussier. "Analysis of the Army’s Transformation Programs and Possible Alternatives." Washington, D.C.: Congressional Budget Office. June 2009.

Megan McKernan, Jeffrey Drezner, John Sollinger. "Tailoring the Acquisition Process in the U.S. Department of Defense." Santa Monica, CA: RAND Corporation. 2015.

Thomas H. Miller. “Does MRAP Provide a Model for Acquisition Reform?” *Defense AT&L*, Vol. 39, No. 4, July–August 2010.

Laurence Newcome. *Unmanned Aviation*. Reston, VA: AIAA, 2004.

Christopher Pernin, et al. *Lessons from the Army’s Future Combat Systems.* Santa Monica, CA: RAND Corporation. 2012.

Gene Porter, et al. *The Major Causes of Cost Growth in Defense Acquisition, Volumes I-III.* Alexandria, VA: Institute for Defense Analyses. Document P-4531. December 2009.

Mark, J. Readeon, and Jeffrey A. Charlston. *From Transformation to Combat: The First Stryker Brigade at War*. Washington, D.C.: U.S. Army Center for Military History. November 2006.

Rojan Robotham. "Predator Acquisition Program Transition from Rapid to Standard Processes." Fort Leavenworth, KS, Master’s Thesis. U.S. Army Command and General Staff College. 2012.

Chris Rohfs and Ryan Sullivan. “The MRAP Boondoggle.” *Foreign Affairs*. July 2012.

Ronald O’Rourke. "Naval Littoral Combat Ship (LCS) Program: Background, Issues and Options for Congress." Washington, D.C.: Congressional Research Service. January 11, 2011.

Carl Schaefer. “Getting War Fighters What They Need and When They Need It.” Maxwell Paper No. 55. Maxwell Paper Anthology. Maxwell Air Force Base, AL. April 2011.

Geoffrey Sommer, et al. "The Global Hawk Unmanned Aerial Vehicle Acquisition Progress: A Summary of Phase I Experience." Santa Monica, CA: RAND Corporation, MR-809-DARPA. 1997.

Michael J. Sullivan. "Rapid Acquisition of MRAP Vehicles." U.S. General Accounting Office, GAO-10-155T. Washington, D.C.: Government Printing Office. October 8, 2009.

Michael Thirtle, et al. "The Predator ACTD: A Case Study for Transition Planning to the Formal Acquisition Process." Santa Monica, CA: RAND Corporation. 1997.

"U.S. Air Force Deploys the Last MC-12 to Afghanistan," *Defense Update*, July 13, 2010.

U.S. General Accounting Office. "Unmanned Vehicles: Assessment of DOD's Unmanned Aerial Vehicle Master Plan." NSIAD-89-41BR. Washington, D.C.: Government Printing Office, 1989.

U.S. General Accounting Office. "Unmanned Aerial Vehicles: DOD's Acquisition Efforts." GAO/T-NSIAD-97-138. Washington, D.C.: Government Printing Office. April 9, 1997.

U.S. General Accounting Office. "Unmanned Aerial Vehicles: DOD's Demonstration Approach Has Improved Project Outcomes." Washington, D.C.: U.S. Government Printing Office. August 30, 1999.

U.S. General Accounting Office. "Unmanned Aerial Vehicles: Progress of the Global Hawk Advanced Concept Technology Demonstration." Washington, D.C.: U.S. Government Printing Office. April 25, 2000.

U.S. Government Accountability Office. "Littoral Combat Ship." GAO-10-257. Washington, D.C.: United States Government Accountability Office. July 15, 2008.

U.S. Government Accountability Office. "Rapid Acquisition of Mine Resistant Ambush Protected Vehicles." GAO-08-884R. Washington, D.C.: United States Government Accountability Office. February 2010.

Richard Van Atta, et al. *Transformation and Transition: DARPA's Role in Fostering an Emerging Revolution in Military Affairs, Volume 2 – Detailed Assessments.* Alexandria, VA: Institute for Defense Analyses, Paper P-3698. November 2003.

Richard H. Van Atta, R. Royce Kneece, Jr., Christina Patterson, Anthony Hermes, Rachel Dubin. *Assessing Weapon System Acquisition CycleTimes: Setting Program Schedules.* Alexandria, VA: Institute for Defense Analyses, Document D-5530. June 2015.

Richard Van Atta, Michael Lippitz, Robert Bovey, Rachel Dubin, Samuel Blazek. *Commercial Industry Research & Development Management Best Practices*. Alexandria, VA: Institute for Defense Analyses, Paper P- 4814. December 2011.

Richard Whittle. "Predator's Big Safari." Mitchell Paper 7. Mitchell Institute for Air Power Studies. Air Force Association. 2011.

# Appendix D.
# Abbreviations

| | |
|---|---|
| ACAT | Acquisition Category |
| AT&L | Acquisition, Technology and Logistics |
| ACTD | Advanced Concept Technology Demonstration |
| AMDR | Air and Missile Defense Radar |
| AMPV | Armored Multipurpose Vehicle |
| ARH | Armed Reconnaissance Helicopter |
| ASD(R&E) | Assistant Secretary of Defense for Research and Engineering |
| ASV | Armored Security Vehicle |
| AT&L | Acquisition Technology and Logistics |
| BBP | Better Buying Power |
| C3 | Communications, Command and Control |
| C4ISR | Communications, Command and Control and Computers, Intelligence, Surveillance and Reconnaissance |
| CAIV | Cost as an Independent Variable |
| COTS | Commercial Off the Shelf |
| CPOF | Command Post of the Future |
| DARO | Defense Airborne Reconnaissance Office |
| DARPA | Defense Advanced Research Projects Agency |
| DDR&E | Director of Defense Research and Engineering |
| DOD | Department of Defense |
| DODD | Department of Defense Directive |
| DODI | Department of Defense Instruction |
| EMD | Engineering and Manufacturing Development |
| ER | Extended Range |
| FCS | Future Combat System |
| GMR | Ground Mobile Radio |
| GAO | Government Accountability Office |
| HAE | High-Altitude Endurance |
| HALE | High-Altitude Long Endurance |
| IDA | Institute for Defense Analyses |
| IED | Improvised Explosive Device |
| IDIQ | Indefinite Delivery/Indefinite Quantity (contract) |
| IFPC | Integrated Force Protection Capability |
| IMINT | Imagery Intelligence |
| IOC | Initial Operating Capability |

| | |
|---|---|
| IOT&E | Initial Operational Test and Evaluation |
| IR | Infrared |
| ISR | Intelligence, Surveillance, and Reconnaissance |
| JASSM | Joint Air-to-Surface Standoff Missile |
| JNN-N | Joint Network Node-Network |
| JPO | Joint Program Office |
| JRAC | Joint Rapid Acquisition Cell |
| JROC | Joint Requirements Oversight Council |
| JUON | Joint Urgent Operational Need |
| KPP | Key Performance Parameter |
| LAV | Light Armored Vehicle |
| LCS | Littoral Combat Ship |
| LRIP | Low-rate Initial Production |
| MDAP | Major Defense Acquisition Programs |
| MRAP | Mine-Resistant Ambush-Protected |
| MSE | Mobile Subscriber Equipment |
| NATO | North Atlantic Treaty Organization |
| NBC | Nuclear, Biological, Chemical |
| NDAA | National Defense Authorization Act |
| NGJ | Next Generation Jammer |
| OCO | Overseas Contingency Operations |
| OSD | Office of Secretary of Defense |
| OT&E | Operational Test and Evaluation |
| OTA | Other Transaction Authority |
| P.L. | Public Law |
| PPBES | Planning, Programming, Budgeting, and Execution System |
| QRC | Quick Reaction Capability |
| R&D | Research and Development |
| RAA | Required Assets Available |
| RFP | Request for Proposal |
| SAR | Selected Acquisition Report |
| SATCOM | Satellite Communications |
| SBCT | Stryker Brigade Combat Teams |
| SIGINT | Signals Intelligence |
| SOCOM | Special Operations Command |
| TTO | Tactical Technology Office |
| UAS | Unmanned Aircraft System |
| U.S. | United States |
| UAV | Unmanned Aerial Vehicle |
| UFP | Unit Flyaway Price |

| | |
|---|---|
| UGS | Unattended Ground Sensors |
| UGV | Unmanned Ground Vehicle |
| UON | Urgent Operational Need |
| USD(AT&L) | Under Secretary of Defense (Acquisition, Technology and Logistics) |
| USD(R&E) | Under Secretary of Defense (Research and Engineering) |
| WIN-T | Warfighter Information Network-Tactical |
| WRAP | Warfighter Rapid Acquisition Program |

| **REPORT DOCUMENTATION PAGE** | *Form Approved OMB No. 0704-0188* |
|---|---|



1. REPORT DATE (DD-MM-YYYY): XX-09-2016

2. REPORT TYPE: Final

3. DATES COVERED (From – To):

4. TITLE AND SUBTITLE: *Assessment of Accelerated Acquisition of Defense Programs*

5a. CONTRACT NO.: HQ0034-14-D-0001

5b. GRANT NO.:

5c. PROGRAM ELEMENT NO(S).:

5d. PROJECT NO.: AB-6-3685

5e. TASK NO.:

5f. WORK UNIT NO.:

6. AUTHOR(S)

Richard H. Van Atta
R. Royce Kneece, Jr.
Michael J. Lippitz

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Institute for Defense Analyses
Strategy, Forces and Resources Division
4850 Mark Center Drive
Alexandria, VA 22311-1882

8. PERFORMING ORGANIZATION REPORT NO.

IDA Paper P-8161
Log: H 16-001036

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Office of Under Secretary of Defense, Acquisition, Technology and Logistics
Room 5A1082
3620 Defense Pentagon
Washington, DC 20301-3620

10. SPONSOR'S / MONITOR'S ACRONYM(S): OUSD (AT&L)A

11. SPONSOR'S / MONITOR'S REPORT NO(S).:

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

A rapidly changing national security environment and rapidly evolving technologies have led to concerns that Department of Defense (DOD) acquisition is not sufficiently responsive to operational needs. In response to a provision in DOD's Better Buying Power 3.0 initiative, IDA conducted research focused on the "cycle time" of DOD acquisition processes—i.e., how long it takes to acquire and field new force capabilities. DOD has taken various approaches in the past to accelerate weapon system acquisitions. IDA selected several historical acquisition programs, each of which was accelerated (either successfully or not) in different ways and in response to different operational needs. The research found that acquisition programs should be accelerated when the value of having the capability sooner is compelling, weighed against the risks of rushing the acquisition process. That tradeoff requires a balancing of current and projected requirements with existing and expected technologies available to meet them. When the tradeoff favors an accelerated acquisition, the research identified several keys to success. Timely innovation to meet future needs requires a coordinated program of technology development linked with prototyping and operational experimentation and employment. Processes to achieve those ends exist to some extent but must be revitalized and funded with higher priority.

15. SUBJECT TERMS Defense acquisition, acquisition cycle time, rapid acquisition, risks in program acceleration

| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT | 18. NO. OF PAGES | 19a. NAME OF RESPONSIBLE PERSON Dr. Philip S. Anton |
|---|---|---|---|---|---|
| a. REPORT | b. ABSTRACT | c. THIS PAGE | | | 19b. TELEPHONE NUMBER (Include Area Code) 571-256-7059 |
| U | U | U | Same as Report | 98 | |

This page is intentionally blank.